PSYCHOSOCIAL IMPACTS OF HYDRAULIC FRACTURING IN LANCASHIRE ENGLAND

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PSYCHOSOCIAL IMPACTS OF HYDRAULIC FRACTURING IN LANCASHIRE ENGLAND

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ABSTRACT

This thesis seeks to determine the psychosocial impact of hydraulic fracturing in Lancashire using the revised Impact of Event Scale (IES-R). No research has been done in the UK on the community impacts of fracking concerning its social impacts in the form of psychosocial stress and community disruption, and cohesion. Data for the research were obtained through a purely quantitative approach. Survey questionnaires were administered in communities within 1 mile of the Preston-New-Road fracking site operated by Cuadrilla Mining Resources. The Preston-New-Road site is in Preston, Lancashire. It is in Poulton-le-Fylde in the Warton and Westby ward.

Consistent with the survey research approach, this research adopted the cross-sectional approach of data collection. This approach is used to determine the prevailing characteristics of a population at a certain point in time. The survey questionnaires were mailed to respondents with a stamped envelope for return to the researcher. The postage package included an introductory letter, questionnaire, and a self-addressed post-paid return envelope.

This study followed standard protocols for quantitative data analysis. Concepts of social capital, perception of recreancy, and community attachment, as well as the revised impact of event scale, were used to determine the initial categories or themes guiding the analysis of the empirical data. Bivariate analysis was used to check the significance of these three variables. The perception of recreancy indicative scale was significant with the IES-R scales, intrusion subscales, avoidance subscales, and the hyperarousal subscales. These findings indicate that as the perception of recreancy increases, psychosocial stress related to hydraulic fracturing would also increase. These research findings have both theoretical and policy implications.

Theoretically, the use of the Impact of Event Scale (IES) and IES-R in natural resource extraction is very limited, and this research expands the literature in this regard. Practically, this thesis confirms that stress is indeed related to hydraulic fracturing. To deal with the stress associated with hydraulic fracturing or other mining activities, policymakers should consider the issue of trust. Measures should be put in place to ensure local residents have trust in the oil and gas companies operating in their communities.

Dedication

This thesis is dedicated to Agnes Dansowaa, my mother, and my late father's memory, Mr Okine Aryee.

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Declaration

I declare that the work contained in this thesis has not been submitted for any other award and that it is all my work. I also confirm that this work fully acknowledges opinions, ideas, and contributions from others' work.

Any ethical clearance for the research presented in this thesis has been approved. Approval has been sought and granted by the Faculty of Arts Design and Social Sciences Ethics Committee on 20th March 2017.

I declare that the word count of this thesis is 75,697 words.

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Acronyms and Abbreviations

UK.	United Kingdom of Great Britain and Northern Ireland
US	United States of America
OECD	Organization for Economic Cooperation and Development
IES	Impact of Event Scale
IES-R	revised Impact of Event Scale
PNR	Preston-New-Road
OAPEC	Organization of Arab Petroleum Exporting Countries
UKOOG	United Kingdom Onshore Oil and Gas
BERR	Department of Business Enterprise and Regulatory Reform
BGS	British Geological Survey
DECC	Department of Energy and Climate Change
NSIP	National Significant Infrastructure Project
EPA	Environmental Protection Agency
IEA	International Energy Agency
NGO	Non-governmental organizations
LSOA	Lower Layer Super Output Areas
MSOA	Middle Layer Super Output Area
ONS	Office for National Statistics
IMD	Indices of Multiple Deprivation
TWh	Terawatt hours
LNG	Liquefied Natural Gas
HSE	Health and Safety Executive

PEDL	Petroleum Exploration and Development License
NORM	Naturally Occurring Radioactive Material
NPPF	National Planning Policy Framework
BBC	British Broadcasting Corporation
PTSD	Post-traumatic Stress Disorder
APA	American Psychiatric Association
DSM	Diagnostic and Statistical Manual
CBT	Cognitive Behaviour Therapy
NARO	Nuclear Accident Response Organisation
ODS	Operation Desert Storm
EMDR	Eye Movement Desensitization and Reprocessing
GCSE	General Certificate for Secondary Education
GCS-A-LEVEL	General Certificate of Education Advance-Level
PRP	Primary Responsible Party
WCED	World Commission on Environment and Development
IUCN	International Union for Conservation of Nature
NDD	Natural Deficite Disorder
PTG	Post-Traumatic Growth
MSG	Most Similar Groups

1.0 CHAPTER ONE: INTRODUCTION

1.1 Introduction

The exploration of shale gas in the UK using hydraulic fracturing ("fracking") is at the early stages. However, estimates suggest enough shale gas to supply the UK for the next 470 years (Stamford & Azapagic, 2014). Hydraulic fracturing is a form of unconventional extraction. A mixture of water, sand, and chemicals is forced into the ground under high pressure to retrieve natural gas from existing shale deposits (Jaspal & Nerlich, 2014). Research on the social impacts of shale gas extraction in the UK is underdeveloped, primarily because it is still a novel practice. This is especially true when it comes to studies on the psychosocial impacts of hydraulic fracturing. As a result, there is a need for more research on this particular outcome of the unconventional gas extraction technique.

Hydraulic fracturing in the UK has been slow to develop. This is likely the case for four reasons. First, gas deposits in the UK are located at an approximate depth of 3000m – 4000m, making extraction difficult (Clark et al., 2012). Second, areas earmarked for fracking are often highly populated than other countries like the United States (US). Third, there are limited numbers of drilling rigs and other equipment in addition to specialised personnel to undertake widespread hydraulic fracturing (Clarke et al., 2014). Finally, the government owns underground natural resources, which can discourage private initiative and involvement (Clarke et al., 2014). As a result, the acquisition of fracking licenses is difficult, and community opposition is often intense.

The environmental externalities of shale gas extraction have been significant setbacks for shale gas extraction and the gas industry's overall sustainability. Environmental problems include the availability of water resources for fracking (in the UK, water availability per capita is relatively low compared to the US), contamination risks posed to underground

and surface water by chemical additives used in fracking, handling, treatment and disposal of wastewater. Hydraulic fracturing effects on biodiversity and overall natural conservation, air pollution, noise pollution, microearthquakes or seismic activity, and greenhouse gas emissions into the environment can negatively impact the ozone layer and cause global warming.

The exact environmental impacts of shale gas extraction in the UK are not fully known because full-scale commercial fracking has not begun. In the US, most mining companies are not mandated to release chemical additives' content. This has made it difficult to ascertain the full-scale environmental impact of fracking (Healy, 2012). This notwithstanding, chemicals such as proppants and other harmful substances have been found in the fluid used in US hydraulic fracturing operations (Waxman et al., 2011).

Supporters of fracking have argued that it will generate a great deal of economic growth, lead to employment, reduce oil and gas prices, and provide a stable supply of energy. Opponents have focused on the negative impacts on the environment and its potential adverse effects on public health. The lack of clarification on this technology's exact environmental implications may increase anxiety and a sense of insecurity among communities and anger and distrust towards state and government agencies (Vanclay et al., 2013).

The Preston community is the first and only community in the UK where fracking has been ongoing since the process was briefly practised and then banned in 2011. Moreover, Preston's hydraulic fracturing operations [1] have generated controversy due to their potential environmental and social impacts (Szolucha, 2016). This controversy has resulted in localised grassroots protests in the Preston area. Many residents have expressed a fear of

[1] Preston is the city and the administrative centre of Lancashire, England

losing their livelihood and property due to the perceived negative impacts of hydraulic fracturing on individuals and the community. Preston residents' fear partially originates from reports of the negative community impacts of hydraulic fracturing operations in the US and Australia, where large-scale hydraulic fracturing has been ongoing for years.

As will be justified below, this thesis aims to evaluate one of the social impacts of hydraulic fracturing in the Preston community. Recent qualitative research suggests that psychological stress is an important issue to consider in communities where hydraulic fracturing occurs (Szolucha, 2016).

This research will notably examine the level of psychosocial stress of residents living near the Preston-New-Road hydraulic fracturing extraction site. Studying the social impacts and community stress, related to hydraulic fracturing is essential if researchers, local planners, and the public gain a deeper appreciation of the implications of shale gas development. In short, hydraulic fracturing related stress may impact mental health outcomes. Hydraulic fracturing can impact mental health by activating the sympathetic nervous system and the hypothalamic-pituitary-adrenal axis, affecting the cardiovascular, metabolic, and immune systems. Current clinical studies have emphasised the role of psychosocial stress as an essential risk factor for physical, and mental disorders that capture the cause of morbidity and mortality particularly in a developed society, and recently in developing countries (Martins & Coetzee, 2007; Tennant, 2000). Moreover, psychosocial variables such as negative mood states such as depression, anxiety, hostility, and poor social support and life event stressors, have been increasingly recognised as a risk factor for coronary heart disease (Tennant, 2000).

The next sections will give a detailed description of what hydraulic fracturing is, and its operation. As explained above, the negative environmental impacts have been a point of

debate in the hydraulic fracturing discourse; therefore, I will discuss the adverse environmental effects. These negative environmental impacts lead to biodiversity loss and climate change. I will also discuss the relationships between biodiversity loss and climate change concerning stress.

1.2 What is Hydraulic Fracturing

Fundamentally, hydraulic fracturing is a process of pumping large amounts of liquid into a wellbore and selected areas of surrounding rock. The fluid is pumped at a high enough pressure that the rock fractures (Yew, 1997). In a natural-gas-bearing shale formation, the challenging but slightly porous rock's cracking helps expose the shale's surface area. It frees natural gas trapped within the shale to travel through the wellbore to the surface, collected, processed, and transported, typically by pipeline (Yew, 1997).

The hydraulic fracturing process proceeds in several steps after the deposits deep inside the Earth is discovered. First, measurements are taken to establish the natural gas's exact location. Second, a well is created by drilling directly into the Earth. The drill will dig down to the precise location, whether it is drilled horizontally or vertically. If it is drilled out horizontally, the drill is turned ninety degrees horizontally and then continue towards the natural deposit. Next, a mixture of water, chemical additives, and sand are pumped at high pressure through the well towards the deposit of natural gas. The high pressure facilitates the breakage of the rock containing the gas, allowing it to escape. It can take about five million gallons of water for each natural gas well. As the natural gas gets through the rock that has been broken by the high-pressure water mixture, it steadily rises towards the surface. From here, it is collected, processed, refined, and distributed. The water that was pumped into the Earth comes back as wastewater (known as flow back

water) towards the surface after all the natural gas has been extracted. The flow-back water is collected and stored in steel tanks, and its injected into oil and gas waste wells

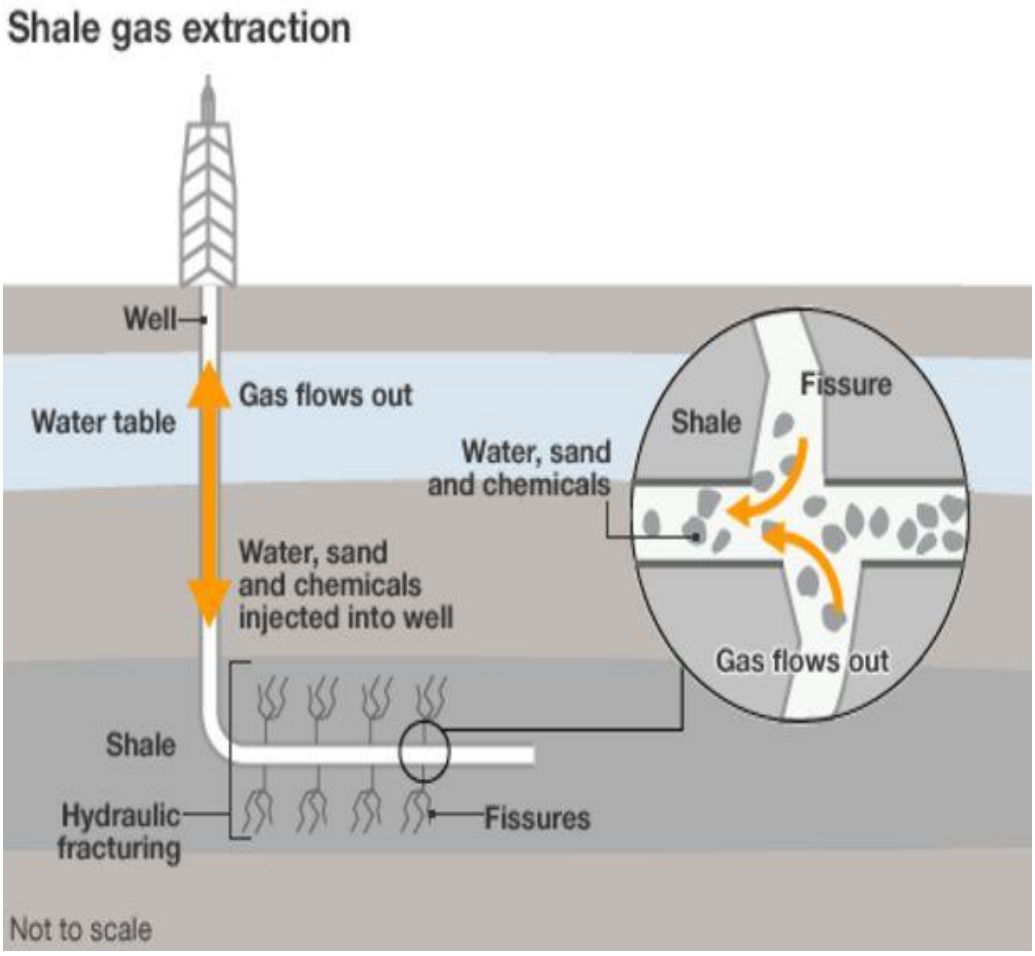


Figure 1.1: A diagram demonstrating the fracking process (Manfreda, 2015).

To enhance fracking effectiveness, water is mixed with chemicals and proppant[2], commonly sand. This mixture is pumped into the rock. The proppant particles are trapped in cracks generated by hydraulic fracturing and help prop them open. This process facilitates the continuous flow of gas through the fractures (Yew, 1997). For decades, operators have experimented with various combinations and concentrations of gels,

[2] A proppant is a solid material, typically sand, treated sand or man-made ceramic materials, designed to keep an induced hydraulic fracture open, during or following a fracturing treatment.

proppants, and water (and sometimes foam) often varying the technique for different formations.

The hydraulic fracturing fluid and proppant nature are generally tailored to the particular geological formation being fracked (Graves, 2013). For the types of shale gas formations of concern here, the hydraulic fracturing mixture tends to be at least about 98% to 99% water and sand, with the remainder comprising any of several substances. These substances can include friction-reducing agents such as polyacrylamides, biocides such as methanol to kill bacteria, scale inhibitors such as hydrochloric acid. And various other materials such as guar gum, borate salts, and isopropanol can help optimise any of a variety of hydraulic fracturing fluid properties such as viscosity and the ability to carry and release proppant (Graves, 2013).

Proppants can vary in terms of grain size, shape, coating, or source. Some form of sand remains the dominant choice. Still, at one time or another, fracturing service companies have tried a host of alternatives, including plastic pellets, steel shot, Indian glass beads, aluminium pellets, high-strength glass beads, rounded nutshells, resin-coated sands, sintered bauxite, and fused zirconium (Graves, 2013). Industry players have been willing to look far and wide for materials to improve fracturing solutions or proppants.

In the 1970s, energy companies borrowed chemical agents from the plastic explosives industry. Such broad experimentation reflects the trial-and-error approach through which hydraulic fracturing has commonly developed. A strategy that at least partly reflects difficulties in modelling the high-pressure dynamics of sand-infused liquids and their interactions with rock formations that can be more than a mile underground. Computer programs are used to plan or simulate hydraulic fracturing operations since the mid-1960s,

but they have failed to remove all elements of personal skill[3] and luck from the process (Graves, 2013).

In any event, hydraulic fracturing has not necessarily proven adequate to make shale gas production economically viable. Even with hydraulic fracturing, traditional vertical wells might not stimulate the release of enough natural gas to justify their cost. Gas is commonly trapped at low densities throughout large shale areas and is often found in the most significant quantities in a small layer of the formation sometimes within a portion of less than one meter thick.

To optimise gas recovery, another technology has frequently been necessary: effective 'directional drilling' in which oil and gas companies drill a well vertically toward the formation that they are targeting, then progressively slant the drill bit, and ultimately drill laterally through the formation, sometimes for over a mile (Reins, 2017). This horizontal drilling can address fracturing containment concerns (limiting fractures to targeted areas of underground rock). More intuitively for the inexpert, it can allow more oil or gas to flow from the shale. Although a horizontal well might cost, say, twice as much as a traditional vertical well, it can also be three times as productive, thereby substantially increasing its overall benefit-to-cost ratio (Reins, 2017).

The existence of a primary rationale for drilling horizontally through shale formations was probably never hard to grasp. Developing the drilling and drill monitoring technologies necessary to do it efficiently was the hard part. Before the 1980s, available technologies were crude. "Early directional drilling involved placing a steel wedge downhole (whipstock) that deflected the drill toward the desired target, but this technique lacked

[3] Ability to effectively combine the right proportion of water, sand, and other chemicals to enhance effective flow of gas

control and consumed time." (Prud'homme, 2014, p.12). A significant breakthrough came in the 1980s by introducing the steerable downhole motor (Prud'homme, 2014). This decade also witnessed the first successful commercial horizontal drilling tests in the oil and gas sector, which began in the early 1980s by a French operator who worked in southwestern France and offshore in Italy. Later in the decade, US operators began applying this technique commercially in North Dakota's Bakken Shale and Texas's Austin Chalk formations.

Figure 1.2: A picture of downhole motor (Prud'homme, 2014)

The 1990s witnessed further significant improvement by developing rotary steerable systems that could be redirected without interrupting drilling by stopping the drill string's rotation. Finally, the development of measurement while drilling technology, first commercialised in 1978, enabled real-time downhole measurement of parameters such as position, temperature, pressure, and porosity. This facilitates better directional control and more efficient and safer drilling, resulting in an even more favourable benefit-to-cost ratio (Prud'homme, 2014).

This section discussed in detail what hydraulic fracturing is and the techniques used for drilling. I also discussed the method of horizontal drilling to enhance efficient drilling. Before I discuss the impact of hydraulic fracturing on psychosocial stress, I will overview

the environmental effects of hydraulic fracturing. This discussion is necessary because perceptions of the environmental impact are often listed as a primary concern for residents living near hydraulic fracturing sites.

1.3 Environmental Impacts of Hydraulic Fracturing

The full-scale environmental impacts of fracking are unknown despite significant study. Environmental impacts of fracking include large amounts of water consumption, land use concerns, air, and water pollution.

The Committee on Energy and Commerce, US House of Representative, found that a component of fracking fluids include proppants and other harmful chemicals. These toxic chemicals can be detrimental to the environment and human health (Waxman et al., 2011). In the US, only recently have energy extraction companies been required to disclose the full contents of fracking fluid and still treat this information as a 'trade secret'. This lack of disclosure, especially in the US, has made it challenging to develop full-scale risk management policies on fracking (Healy, 2012). In the UK, however, energy extraction companies are mandated to disclose the full chemical contents of their fracking fluids (Bullis, 2013). Water usage in fracking is a real problem, especially in areas that are prone to water shortages. Surface water may become contaminated from spillage and improper waste pits which are not adequately built or maintained.

According to Broomfield (2013), there is a high probability of methane gas from fracking leaking into surface water and the atmosphere, negatively affecting people living close to drilling sites. Broomfield also noted that the rate of methane gas leakage is higher in older wells than in newly constructed wells. The effects of surface water pollution from chemicals used in fracking and the subsequent leakage of methane into surface water is catastrophic in the sense that, the produced water (the fluid that returns to the surface) is

treated by commercial and municipal waste management treatment systems (Logan et al., 2012). This may eventually get into the public water system and can cause devastating health issues due to water pollution if not properly treated. I will now discuss other environmental impacts of fracking, including air emissions and climate change, water consumption, water contamination, and seismicity.

The effects of fracking on air emissions and climate change are controversial. Research has revealed that methane gas from wells, odours that emanate from hydraulic fracturing equipment and diesel fumes are potential sources of pollution from fracking. Toxic chemicals and gases dissolved in flow-back fluid from wells have the potential to cause emission risks (Broomfield, 2013). There is a debate about whether gas emissions from fracking causes higher greenhouse gas effects, thereby contributing more to climate change than conventional fuels such as coal. Some studies have found that shale gas from fracking has higher emissions due to the release of methane gas during well completion and fracturing fluid return. This debate is ongoing in the UK (see Broderick, 2011; Friends of the Earth, 2013).

There is little literature on shale gas's global warming potential in the UK because shale gas exploration in the UK is relatively new. Global warming potential is a measure of how much heat a greenhouse gas (such as carbon dioxide, methane, and water vapour) can trap in the atmosphere. However, a recent study by Stamford & Azapagic (2014) examined the life cycle environmental impacts of shale gas in the UK and found that the global warming potential of shale gas is comparable to conventional fuels such as coal.

Stamford & Azapagic (2014) also found that abiotic depletion of shale gas is 50-80% higher than conventional gas but about 19-24 times lower than solar photovoltaic system (PV) or offshore wind. Their research indicates that shale gas's acidification potential is 4.1-7.5 times higher than conventional gas. However, shale gas's eutrophication potential is

comparable to traditional gas, but it is 2.3 times worse than offshore wind and 8.8 times worse than nuclear. The freshwater eco-toxicity potential of shale gas is 60% to 3.8 times worse than conventional gas. The human toxicity potential of shale gas is 2.9-4.4 times worse than conventional gas. The aquatic toxicity of shale gas is 2-5 times worse than conventional gas, within a similar range to the nuclear and offshore wind but better than coal or solar PV by 45 times and 7.8, respectively. The ozone layer depletion potential of shale gas is lower than conventional gas. The terrestrial ecotoxicology potential of shale gas is about 13-26 times worse than conventional gas.

The most-cited estimate of greenhouse gas released by shale gas is Howarth et al., (2011). They estimated the global warming potential of shale gas is greater than that of coal. However, various researchers have criticised this assertion (Burnham et al., 2012; Cathles et al., 2012; Hultman et al., 2011; Logan et al., 2012.; O'Sullivan & Paltsev, 2012; Weber & Clavin, 2012). Previous literature has focused on the global warming potential of shale gas and other conventional gases. Except for Howarth et al., (2011) all other studies estimate that electricity production from shale gas has similar global warming potential to traditional gas. Jiang et al. (2011) estimated that shale gas-fired combined cycle gas turbines have a 7.4% higher global warming potential than conventional gas. Hultman et al. (2011) estimate this difference at 11%, while Stephenson et al. (2011) estimate this difference at 2.4%, both in favour of conventional gas. Logan et al. (2012) found that shale gas's global warming potential is within a similar range to traditional gas. Burnham et al. (2012) found that shale gas's global warming potential is about 6% lower than conventional gas.

In summary, focusing only on climate change, cost and energy security, shale gas is a viable option that can be considered a bridge between conventional gas and other renewable energy resources such as wind and solar.

Fracking processes require so much water that they can deplete local resources (Entrekin et al., 2011). Fracking of shale wells requires approximately 1.2 to 3.5 million US gallons (about 4500 to 13200 m^3) of water per well. This water quantity can exceed 5 million US gallon (around 19000 m^3) for larger projects (Abdall & Drohan, 2010; Andrews et al., 2009). Research has shown that an average shale gas well will require between 3 million to 8 million US gallons (11000m^3 to 30000m^3) of water over its entire life span (Abdall & Drohan, 2010; Arthur et al., 2010).

There are concerns that fracking will require water volumes that would deplete local water resources (Entrekin et al., 2011). However, the amount of water used for fracking is dependent on the geology of the area, length, and depth of the well and the stages of fracking. An operator in the UK is mandated by the 1991 Water Resource Act to seek approval from the Environmental Agency if more than 20m^3 of water is to be withdrawn from ground or surface water (The Royal Society, 2012). One estimate suggests that the amount of water needed for fracking of a shale gas well for a decade is equivalent to the water volume required to water a golf course for one month. And also comparable to the amount of water needed to power a coal fired-plant of a thousand megawatts' for 12 hours or the amount lost every hour to leaks to the United Utilities region in the North West of England (The Royal Society, 2012).

Research is currently underway to find alternatives to excessive water use in fracking. Some researchers advocate for the use of liquid propane or liquid carbon dioxide instead of water (Bullis, 2013). The use of liquid carbon dioxide will help eliminate millions of gallons of water in a single well. It will also address the problem of wastewater discharge and treatment during hydraulic fracturing.

Another primary environmental concern from fracking is water contamination through injected fluids, flow back and water spills. A typical fracturing fluid contains

approximately 0.17% of chemical additives. These additives' composition includes scale inhibitors, acid, biocide, friction reducer, and surfactant (The Royal Society, 2012).

A 2011 report by the United States House of Representatives Committee on Energy found that out of about two thousand five hundred chemicals used as additives in fracking, six hundred and fifty-two of those are well-known human carcinogens under the Safe Drinking Water Act. Additionally, some of these additives are among those listed in the Clean Air Act as dangerous air pollutant (Waxman et al., 2011).

The European Union requires the full disclosure of additives used for hydraulic fracturing (Healy, 2012). This assertion is confirmed by the 2006 EU groundwater directive, "To protect the environment, and human health, particularly detrimental concentrations of harmful pollutants in groundwater must be avoided, prevented or

reduced"[4]. Engelder et al. (2014) estimated that less than half of the water used in hydraulic fracturing (injected fluid) is returned as flow back, and less than 30% of the injected water is recovered. The percentage of flow back that returns to the surface after hydraulic fracturing is estimated to be between 15-20% to 30-70% (Arthur et al., 2010). This may contain substances such as brine water and other minerals. Depending on a particular area's geology, this flow back may have radioactive materials such as radium, thorium, and uranium (Weinhold, n.d.).

Micro-earthquakes or induced seismicity are another possible environmental impact of fracking. Seismicity is a sudden process that results in the release of energy in the form of vibrations that travels through the Earth as waves (in this case, seismic wave) (McGarr, 2014). Seismicity happens when rocks break and slide past each other or when rocks break

[4] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006L0118

under high tension. Seismicity associated with hydraulic fracturing activities is known as induced seismicity or microearthquakes.

The magnitude of seismicity caused by hydraulic fracturing activities depends on the volume of fluid injected during each fracking activity or operation (McGarr, 2014; Westaway & Younger, 2014). According to Zoback et al. (2010), the magnitude of these microearthquakes is small, averaging around 1.5 on the Richter scale. Furthermore, Galloway (2012) estimated the magnitude of microseismicity to be at most 2.3 on the Richter scale.

In April and May of 2011, exploratory fracking operation in the UK by mining giant Cuadrilla induced microseismicity of magnitudes 1.5 and 2.3, respectively on the Richter scale (Westaway, 2016). Due to these two events, the UK government banned fracking in England temporarily from 2011. The ban has since been lifted. In 2015, the Scottish government also placed a moratorium on hydraulic fracturing activities due to seismicity uncertainties (Freeman, 2015).

This section has examined the various environmental impacts of fracking on air emissions and climate change, water consumption, water contamination and seismicity. These environmental impacts have diverse negative effects on both residents living in fracking communities and potentially the entire UK. The next section of this chapter will attempt to link environmental degradation, such as biodiversity loss and climate change to psychosocial stress, which is the core goal of this thesis.

1.4 Environmental Degradation and Psychosocial Stress

Environmental degradation is the exhaustion of the world's natural resources: land, air, water, soil, etc. It occurs due to crimes committed by humans against nature (Gómez & Nichols, 2010). People dispose of wastes that pollute the environment at rates exceeding

the waste's decomposition rate or dissipation. Individuals are also overusing renewable resources such as agricultural soils, forest trees, ocean fisheries, etc. at rates exceeding their natural abilities to renew themselves. Therefore, the environment's capacity to withstand the negative impacts of human activities has diminished, and environmental degradation has become a threatening issue.

To most investors, overexploitation of natural resources is more profitable in the short run, due to cheap means of disposing of wastes, avoiding the costs of waste treatment, and excluding social losses in cost calculations. However, in the long-run natural resources will be depleted, and the losses will be irreversible. Due to the severity of environmental degradation worldwide, the World Bank and other ecological institutions have conducted studies to present a cost assessment of environmental degradation (El-Haggar, 2007).

Until humans meet their basic needs, they will not be motivated to protect the available natural resources. Human resources are the most crucial element to reform. Developing these resources is the first step of reform. According to Abraham Maslow's theory of human needs, one cannot expect the individual to be motivated further and take positive actions to society's improvement without satisfying the basic physiological needs (Maslow, 1943). We cannot discuss reform without providing healthy food for eating, clean air for breathing, clean water for drinking.

Maslow's hierarchy of needs reveals that individuals tend to fulfil particular needs before others. The most fundamental needs are physiological needs: oxygen, food, water, etc., anything that they need to survive. In order of importance to individuals, the other needs are safety and security, love and belonging, self-esteem, and finally, at the peak of the hierarchy is self-actualization (Sarma & Hoek, 2004).

Environmental degradation prevents individuals from attaining their two most basic needs: physiological, and safety and security. Due to the depletion of natural resources such as air, soil, water, etc., people are less likely to have clean food, clean water, and good quality air. Also, the widespread disease and disruption of natural ecosystems do not provide a safe environment for people to live in because of the high risk of disease breakout or natural disasters; hence safety and security needs are unfulfilled (Sarma & Hoek, 2004).

These two basic needs are deficiency needs; if a deficiency occurs in any of them, individuals will directly eliminate it. Therefore, individuals will be reluctant to undergo any effort towards political, economic, social, or cultural reform unless their basic needs are fulfilled and sustained.

The degradation of our environment impacts our health and well-being, and this impact is the focus of increasing interest on the part of psychologists, physicians, architects, and environmental scientists (Johnson et al., 2013). Stress has become a popular concept for explaining a wide variety of outcomes, mostly, adverse that otherwise seem to defy explanation. Scientifically, stress is identified as a precursor of illness (Johnson et al., 2013) due to any number of conditions, or as a catchall for anxiety reaction, discomfort, etc. From reading psychological and medical texts and listening to people, one can derive a broad definition of stress. Stress refers to a specific and central process to the relationship between people and their surroundings (Johnson et al., 2013).

Stress is defined as the process by which environmental forces or events, known as stressors, threatens an organism's existence and well-being, and by which the organism responds to this threat. The stress reactions are associated with symptoms such as anxiety, fear, and anger. These symptoms are easily recognized, however, it may only represent the side effect of the primary reaction (Kogler et al., 2015). Our lives are characterized as a constant adaptation to sudden change or gradual evolution of our environment. Sometimes

these changes are minor, and we can adapt to them without being aware of them. At other times, however, these changes can cause stress.

Stress is a co-factor in 95% of all disease processes (Kogler et al., 2015). A keystone of holistic, alternative health and healing is learning how to manage stress effectively (Kogler et al., 2015). This learning process begins with recognizing or identifying four specific types of stress affecting you and how these stressors (that is, what demands a change from you) show up or manifest as symptoms in your life. Stress factors broadly fall into four types or categories**: (1) physical stress, (2) psychological stress, (2) psychosocial stress,** and **(3) psychospiritual stress.** The focus of this thesis is on psychosocial stress.

Psychosocial stress is the imbalance between demands placed on us, and our ability to manage them (Kogler et al., 2015). It results from a cognitive appraisal of what is at stake and what can be done about it. It also is the result of what we perceive as a threat to our lives. I will discuss psychosocial stress further in chapter four.

There have been some studies that examine the psychological effects of environmental degradation. However, these studies have found a positive correlation between environmental degradation and psychological distress (Sartore et al., 2008; Van Haaften, 1996; Van Haaften & Van De Vijver, 2003; Van Haaften & Van de Vijver, 1996; Van Haaften et al., 2004). There is also a strong association between many forms of psychological distress and the onset of depression illness (Rose, 1994). I will discuss the relationship between environmental degradation and stress, also in chapter four.

This section described what hydraulic fracturing is and the perceived environmental impacts of fracking. These perceived environmental impacts were linked to the cause of mental health disorders such as posttraumatic stress disorders. I briefly introduced stress and types of stress. The next section discussed the community impact of fracking to better

contextualize the psychosocial stress analysis undertaken in this thesis. This thesis is about the community impact of fracking, hence, the usefulness of the next section.

1.5 Community Impacts of hydraulic fracturing

Hydraulic fracturing impacts on communities are diverse and categorized into primary, secondary, and tertiary impacts. The discussion of these different types of impacts helps contextualize psychosocial stress as a tertiary impact. As will be discussed below, the tertiary effects of hydraulic fracturing are often associated with psychosocial stress (Scott, 2017).

Primary Impacts: The immediate impacts of hydraulic fracturing or the initial phase of unconventional natural gas extraction are characterised by increased employment opportunities for local communities where these extractive activities take place. However, with time, the demand for specially skilled labour often exceeds availability in the local communities causing companies to bring in employees outside the community. This labour demand, however, is skewed towards males. Even when females benefit from the job boom, males' salary rates are much higher than females' (Obeng-Odoom, 2015). Research has found a positive correlation between increased employment and energy industry sitting, especially coal gas extraction. Black et al., (2005) conducted a study in the US between the years 1970 and 2000, in which they found that employment increased in counties hosting extractive industries and this rate of work lasted over a long period.

Likewise, Caselli & Michaels (2013) examined data from Brazil in which they concluded that petroleum extraction in Western Brazil had increased employment a great deal in that region. Marchand (2012) conducted similar research in Canada and observed similar employment patterns during the 1990s natural gas and coal boom era. Another significant primary social-economic impact of natural gas extraction is that employees inject income

into the local community (Ivanova & Rolfe, 2011; Storey, 2010). This initial economic boom may diminish over time as production from the gas well goes down, and demands adjust to meet supply (Chapman et al., 2015; Haggerty et al., 2014).

Another social impact of natural gas extraction in the primary phase is the issue of compensation. Before natural gas extraction (in this case, fracking) can occur, the land needs to be acquired. A private individual owns the land and is sometimes already used for other economic activities (Obeng-Odoom, 2014). Regions and countries have different views and policies toward compensation issues. As a result, various stakeholders must discuss what should go into compensation claims (Jacquet & Stedman, 2011). Discussion on compensation sometimes addresses concerns such as noise and privacy disturbance (Kinnaman, 2011). Jacquet & Stedman (2011) suggest that governments must implement policies that enhance effective compensation dialogue.

One prominent research strand posits that communities or regions that do not have natural resources (such as gas, oil, etc.) are better off economically than those regions where natural resource extraction occurs. The term 'resource curse' is associated with this phenomenon (Douglas & Walker, 2013; Fleming et al., 2015; Paredes et al., 2015). Headwaters Economics (2008) found that the average growth rate in US counties where natural gas extraction occurs is approximately 2.3% per annum, while counties with natural gas have roughly 2.9% per annum. James & Aadland (2011) researched income growth between two US states: Maine (no natural gas extraction common) and Wyoming (natural gas extraction) between the years 1980 to 1995. They found that Maine's income growth increased by 1.8% over that period, while income growth in Wyoming decreased to 0.2% in Wyoming during that same period.

Secondary Impacts: The secondary Impacts of hydraulic fracturing in a community directly follow the primary impacts. As natural gas extraction goes into full-scale

production, diverse income sources, and new employment create various income opportunities. The different income opportunities are likely to attract people seeking 'greener pastures' into the community (Black et al., 2005). According to Michaels (2011), the increase in population are likely to correspond with higher rates of consumption in the community. The higher consumption rate will impact other sectors of the local economy, such as services and goods. Accommodation and land acquisition are other sectors where demand can be significantly high (Measham et al., 2016).

This demand is due to increased demands by new temporary and permanent residents relocated to the area (Measham et al., 2016). The increase in population will positively affect the rate of consumption of non-local goods that local firms may have supplied or sought outside the community (Measham et al.,2016). The overall community changes will also lead to increased demand on other sectors of the economy (Black et al., 2005).

Tertiary Impacts: The tertiary impacts of hydraulic fracturing are felt primarily in need of increased infrastructure in resource-dependent communities. Local governments will need to build and renovate existing infrastructures to be able to serve the increased population. Infrastructure upgrades may include transportation such as rail networks and roads, and utilities such as sewerage and water services (Obeng-Odoom, 2014). The possibility that local governments may not provide these facilities adequately and may need support from higher government levels is high, necessitating the need for effective government consultation and co-operation (Schandl & Darbas, 2008).

A common effect in regions where natural resource extraction has led to an initial economic boom is an increase in housing costs. This increase in house price is due to over-demand for accommodation and a limited supply in existence to meet these needs (Ennis et al., 2014; Haslam et al., 2013). This problem can force both low-income households, and single-parent-headed households to move out of the community (Measham et al., 2016).

These problems cause out-migration. It can also increase poverty as the high property cost means few people can afford to buy houses. The high cost of living also disadvantages residents who do not benefit directly from the extractive industry (Measham et al., 2016).

Black et al. (2005) found that the number of males between the ages of 20 to 39 years in a boomtown in the US is more than the number of females. Therefore, the impacts of natural gas extraction are felt differently by males and females (Baker & Fortin, 2001; Hansen & Wahlberg, 2008). For example, females in other sectors of the economy, such as health care do not get similar pay rises as their male counterparts in the extractive industry (Measham et al., 2016). Research has also shown that the sex industry often grows in resource boom communities, an industry typically dominated by females (Obeng-Odoom, 2014).

The predominantly male workforce in resource boom communities can lead to social disruption, leading to social problems such as drug abuse, prostitution, alcoholism, and crime or violence (Lawrie et al., 2011; Stedman et al., 2012). Frantál & Nováková (2014) confirmed this assertion in their study on coal extraction in the Czech Republic. They found that coal extraction increased crime rates, unemployment as well as homelessness in the Czech Republic. Similarly, Haggerty et al. (2014) in their study on the relationship between oil and natural gas specialisation and socio-economic well-being between 1980 and 2011 in the US states of Montana, Colorado, North Dakota, New Mexico, Wyoming, and Utah, found that high crime rates characterise regions where oil and gas extraction have been on-going for extended periods.

Haggerty et al. (2014) discussed the emergence of natural resource extraction within a community which often leads to the loss of entrepreneurial skills in the community's citizens. They note that college-age students preferred to take up high-earning jobs in the extractive industry instead of going to school. This situation decreases education levels in

the community (Glaeser et al., 2012). Empirical studies have supported the finding that extraction activity is negatively associated with education levels (Black et al., 2005; Gylfason, 2000; Gylfason et al., 1997; Papyrakis & Gerlagh, 2007).

Resource extraction booms, when managed well, can have positive impacts. After expanding the offshore extractive oil industry in Louisiana, increased crime levels were reported (Gramling & Brabant, 1986). However, this expansion fostered novel ideas in the region as pressures on jobs and infrastructure increased. The demand for infrastructure expanded residents' worldviews, goals, and aspirations. According to Brown et al. (2011), increases in population and the subsequent increases in pressure on educational facilities can facilitate youth mobility as they can undergo further education and training and employment in other sectors of the economy.

This cycle of economic boom and slow down due to diminishing demand may not happen in the UK. This is because it is likely local communities may not be completely reliant on resource extraction for economic growth (Measham et al., 2016) as is the case in the US where gas extraction often occurs in very isolated communities. However, when discussing potential natural resource extraction-based development in communities in the UK, tertiary impacts should be considered.

Community stress

Extractive activities increase the psychosocial stress levels of community members. According to Scott (2017), psychosocial stress is "the result of a cognitive appraisal (your mental interpretation) of what is at stake and what can be done about it" (Scott, 2017, p1). Psychosocial stress results when we look at perceived social anxiety in our lives and discern that it will require resources we do not have (Scott, 2017). Anything that translates to a (perceived) threat to our social esteem, social status, acceptance/rejection within a

group, respect, or a danger that we feel we have no control over can elicit psychosocial stress.

Many of the community impacts discussed in the previous paragraphs also elicit stress among residents living in resource extraction communities. There have been many concerns about the environmental, social, and health impacts of unconventional gas extraction. These concerns can be felt as soon as there are rumours of the intervention, much earlier than when the actual project starts. This creates uncertainty in local community members' minds and subsequently fear, anxiety, and anger may set in (Vanclay, 2012). For example, research on the social impacts of an earthquake caused by gas extraction in the Netherlands found that most residents complain of health issues such as depression, anxiety, insomnia, and stress (van der Voort & Vanclay, 2015).

The media can also generate stress in resource extraction communities. Media attention in a community may create a situation where residents have to continuously talk about the effects of hydraulic fracturing on their life to the media generating uneasiness and discomfort. When this continues over time, it leads to a diverse range of physical and mental ailments (Wilkinson & Marmot, 2003). These possible impacts may increase residents' stress due to the increased uncertainty that resource extraction brings.

This section described the community impact of hydraulic fracturing and community stress. The effects of hydraulic fracturing in the community are felt in the primary, secondary, and tertiary phases of extraction, and can have negative and positive impacts. These negative and positive community impacts elicit psychosocial stress, and in fact, psychosocial stress starts as soon as there are rumours of extraction in the mass media. The next section will discuss the problem statement and the theoretical basis of this thesis.

1.6 Problem Statement

No research has been done in the UK on the community impacts of fracking concerning its social implications in the form of psychosocial stress. This thesis will fill this gap. The study of psychosocial stress is based on the premise that: diverse views on fracking impacts by bureaucrats, experts, and social groups will make people living in proposed fracking sites anxious and fearful. This tends to either disrupt or enhance social capital (how the individuals relate to one another and authorities) and elicit psychosocial stress because of fear of loss of properties and self-esteem, among other issues.

Theoretical Bases and Research Questions.

The extraction of shale gas occurs in communities where the land was previously used for other economic and commercial activities such as farming. Due to the lack of literature on the environmental and social impact of fracking in the UK, it is understandable residents living in such communities will have a lot of concern about its negative implications as the whole operation is novel to them. The social issues related to fracking are distrust, feelings of insecurity, increased anger against the gas industry and government institutions, and a decline in house or property rates. These social impacts have the likelihood of making residents feel vulnerable and stressed. There are different reasons that developments like hydraulic fracturing may stress residents in a community. The reasons for community stress in this thesis hinge on three theoretical perspectives; community attachment, social capital, and recreancy perception.

Community attachment is the reflection of the solidarity of social relations that exist among residents in a community. Kasarda & Janowitz (1974) viewed the local community as a complex system of friendship and kinship networks and formal and informal associational ties rooted in family life and the on-going socialisation process. The

weakening of social bonds in a community will decrease a community's social importance and reduce community attachment. Chapter three will discuss further, the community attachment theory and its relationship to psychosocial stress. From this theory, I hypothesised that as community attachment increases, stress related to hydraulic fracturing would increase.

The central theme in the social capital theory is that ‘relationships matter’ (Cohen & Prusak, 2001). Although the social capital concept recently became fashionable, the term has been used for almost a century, and its idea goes back even further. Social capital is defined by the Organization for Economic Cooperation and Development (OECD) as "networks together with shared norms, values, and understanding that facilitate co-operation within or among groups." (OECD, 2017, p103).

In this definition, we can think of networks as real-world links between groups or individuals, networks of friends, family networks, networks of former colleagues, and so on. Our shared norms, values, and understandings are less concrete than our social networks. Sociologists sometimes speak of norms as society's unspoken and largely unquestioned rules. Norms and understandings may not become apparent until they are broken. If adults attack a child, for example, they breach the norms that protect children from harm.

Values may be more open to question; indeed, societies often debate whether their values are changing. And yet, values such as respect for people's safety and security, are an essential linchpin in every social group. Put together, these networks and understandings engender trust and so enable people to work together. I will discuss social capital in detail in chapter three. From the social capital theory, I hypothesised that an increase in social capital in a community would increase stress associated with hydraulic fracturing.

Freudenburg theorised the term perception of recreancy to encompass the behaviour of persons or institutions that hold a position of trust or responsibility but fail to live up to what they have been tasked to do (Freudenburg, 1993a). Increased perception of recreancy lowers the trust that people have for an individual or an institution. This concept is discussed further in chapter three. I hypothesised that as the perception of recreancy increases, the reported level of hydraulic fracturing stress would also increase.

The Revised Impact of Event Scale (IES-R) is an index used to measure the level of posttraumatic stress experienced after an event (Weiss & Marmar, 1997; Weiss, 2007a). This index is compatible with the concept of psychosocial stress, which is the focus of this thesis. The IES-R is an easy-to-administer questionnaire used to evaluate the degree of distress respondents feel after a traumatic event, such as the siting of an extraction site. The IES-R is composed of twenty-two self-reporting questions that assess how stress is built up after a traumatic event (Wilson & Keane, 2004). This thesis aims to evaluate the potential social impact of fracking, stress, by investigating the potential role of sociological variables on hydraulic fracturing-related stress in the Preston-New-Road community. I particularly examine the psychosocial stress of residents residing near this fracking site as a function of community attachment, recreancy, and social capital. To justify this investigation, the research seeks to answer the following three research questions:

Research Question 1. Is there a theoretical justification for applying the IES-R literature to hydraulic fracturing?

Research Question 2. Do residents in the Preston-New-Road community report that hydraulic fracturing is linked to stress as measured by the IES-R?

Research Question 3. Do the sociological concepts of community attachment, perception of recreancy, and social capital explain the variation in the Preston-New-Road community's fracking-related stress?

1.7 Research Design and Methodology

This research employed a quantitative methodological approach to answer the research questions, achieve the research aims and objectives, and use a deductive approach, using empirical data to test patterns and concepts known in theory (Bhattacherjee, 2012). A deductive research approach requires developing hypotheses based on pre-existing theory and developing a research approach to test the hypothesis. These hypotheses are set out above and described in detail in chapter seven. The hypotheses are based on the community attachment, perception of recreancy, and social capital theoretical approaches, and uses the revised Impact of Event Scale (IES-R).

A survey questionnaire was the primary medium by which data was collected to answer the research questions and address the hypotheses. The survey questionnaire was administered through the post, known as a mail survey. Mail surveys are cheap, and the data is of high quality when the questionnaires are appropriately laid out (Lavrakas, 2008).

The Preston-New-Road fracking site is at the Westby ward of Preston. The Westby ward has 653 registered properties, and the immediate village to the Westby ward is Wrea Green. Wrea Green has 483 registered properties. I posted the survey questionnaires to every registered property, and 198 respondents returned their questionnaires via the post-paid enclosed envelop provided in the package.

Figure 1.7 below is an indicative research methodology for this research. This methodology is vital to answering the research questions, hypothesis, and achieving the research aims and objectives.

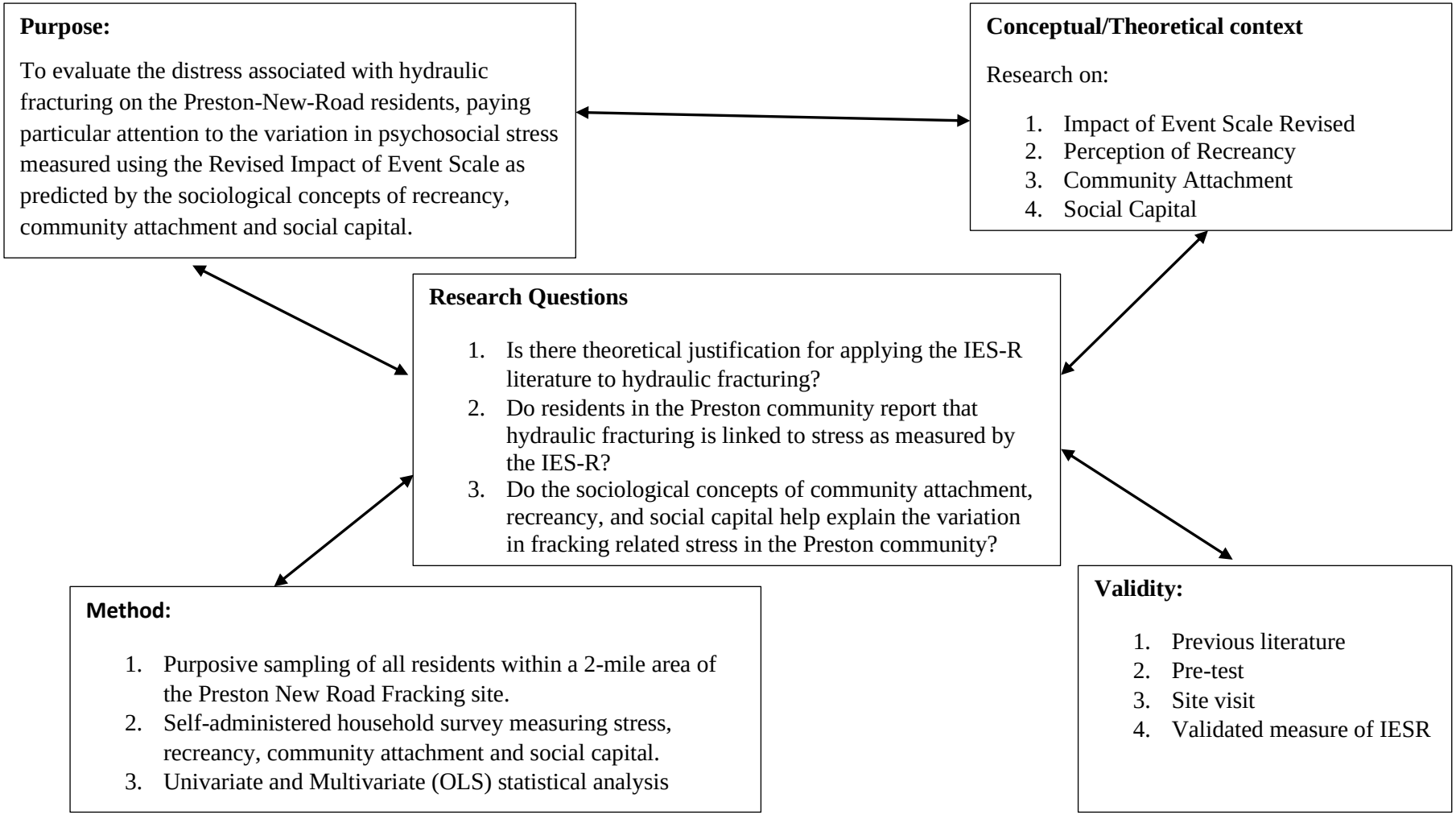


Figure 1.3: Indicative research design

1.8 Scope and Limitation of this Study

The research is on the community impacts of fracking in England. This research primarily focuses on whether fracking enhances or disrupts social capital in extraction communities and how fracking perceptions contribute to stress among individuals living in these communities. There are approximately ten (10) potential hydraulic fracturing sites in the UK; these are:

i. Preston-New-Road, located in Lancashire: the type of fracking earmarked is shale gas appraisal wells. Site construction is currently underway.

ii. East Midlands: the type of fracking earmarked is a seismic survey, and survey work is imminent.

iii. Broadford Bridge, located in West Sussex and the type of fracking earmarked is shale gas exploration well, drilling is imminent.

iv. Kirby Misperton, located in Yorkshire: the type of fracking earmarked is shale gas appraisal wells, and fracking permission has been granted.

v. Brockham in Surrey: type of fracking is tight, or shale oil and the pre-set status is a side-track drill.

vi. Tinker Lane, located in North Blyth: the type of fracking earmarked is shale gas exploration well, and the current fracking status is that formal planning decision has been granted.

vii. Mission, at North Doncaster: the type of fracking earmarked for this site is shale gas exploration well, and the current status is that the planning decision has been approved.

viii. Roseacre, located in Lancashire: the type of fracking activity earmark for this area is shale gas appraisal well, and the current status is that planning inquiry has been re-opened.

ix. Horse Hill, located in Surrey: the type of fracking earmarked for this area is shale gas exploration well, and the current status is that a new planning application has been submitted.

x. Pontrhydfen, located in Wales and the type of fracking earmarked is shale gas and coal bed methane, and the current status is that planning is live, but there is no activity yet.

This research focuses on the Preston-New-Road fracking site. This site is the first to begin exploratory fracking in the UK after the 2011 ban on fracking was lifted. The Preston-New-Road site is also likely to be the first site where full-scale commercial fracking will commence in the UK if the current moratorium placed on November 1st, 2019 is lifted. Moreover, considering the limited time limit of this research, it is appropriate and convenient to get enough data as soon as reasonably possible to achieve a realistic outcome, and the Preston-New-Road site is the best option available.

Although this research will not cover all ten potential fracking sites in the UK, it is anticipated that the results of this research can be generalised and applicable to the other potential fracking sites. Future research will be able to build on this work.

1.9 The Structure of the Thesis.

This thesis is made up of eight chapters. The brief content of each chapter is as follows:

Chapter one is the introduction chapter. This chapter outlines the research background, the research problem, theoretical perspective, and the research questions.

Chapter two focuses on the Preston-New-Road fracking site, the primary data collection point of this thesis. The socio-economic condition is discussed, and this chapter ends with a focus on the operations of the mining giant Cuadrilla Mining Resources.

Chapter three is the theoretical basis of this thesis. This chapter operationalized the research hypothesis regarding Community Attachment, Social Capital, and Perception of Recreancy Theory. This chapter justifies the hypothesis and sets the tone for the rest of the chapters.

Chapter four discusses the instrument used to measure psychosocial stress in this thesis, i.e., The revised Impact of Event Scale (IES-R). It answers research question 1: Is there a theoretical justification for applying the IES-R literature to hydraulic fracturing? The chapter is divided into two parts. Part one begins by giving a general overview of the relationship between the environment and stress and the difference between different stresses. The IES and the IES-R difference are discussed and the three indexes of the IES, i.e., Intrusion scale, avoidance scale, and the hyperarousal scales. Part two of this chapter examines the literature to determine how the IES-R has been applied in previous and current literature that examines traumatic events in communities.

Chapter five presents the data and methodology. This chapter provides the research philosophy, research approach, and research strategy of this project. It describes the justification of the research method and data collection method used.

Chapter six is the first analysis chapter. It uses the IES-R description to answer research question two: Do residents in the Preston-New-Road community report that hydraulic fracturing increases community stress/disruptions.

Chapter seven is the second analysis chapter. This chapter answers research question three: Do the sociological concept of community attachment, perception of recreancy, and

social capital help explain the variation in fracking-related stress in the Preston-New-Road community?

Chapter eight is the conclusion and policy recommendation chapter. This chapter is divided into two parts. Part one discusses the research outcome in terms of fulfilling the research aims and objectives, and whether the research hypotheses have been supported and whether the research questions have been adequately answered. This part also highlights the thesis' practical and theoretical implications and suggests areas for future research. Part two discusses the factors that influence the perception of fracking in the Preston-New-Road site and offers ways to manage future hydraulic fracturing sites better to ensure sustainability, equity, and reduced psychosocial stress. Part two ends by mapping out the implications of this research for other areas such as environmental justice and discusses fracking and its alternatives' ethical perspective.

1.10 Chapter Summary

This chapter outlined the framework for this research considering its background, research aims, and objectives. This chapter also presented the indicative research methodology framework and structure of the thesis. The next chapter discusses the research setting at the Preston-New-Road fracking site. It also discusses energy transition and available fracking policies in the UK.

CHAPTER TWO: PRESTON-NEW-ROAD FRACKING SITE, ENERGY TRANSITION AND FRACKING POLICIES

2.1 Introduction

This chapter aims to provide essential detail about the study setting and local context for this thesis. Specifically, this research relies on a survey (described in Chapter 5) administered in Lancashire, the United Kingdom in an area known as Preston-New-Road. This site serves as the only operating hydraulic fracturing site in the UK. Hydraulic fracturing at Preston-New-Road occurred between January 2017 and November 2019. Because this thesis focuses on one area in the UK (Preston-New-Road), this chapter describes this area in detail, noting how it is different from other areas in Lancashire and the UK in general.

The chapter is divided into two parts. Part one describes the town's social-economic characteristics, including its geography, land use, and economic activities. Part two briefly describes the source of natural gas in the UK and the political forces that led to the approval of one of the first fracking sites in the U.K. Part two also discuss the company involved in the hydraulic fracturing operation in Preston-New-Road.

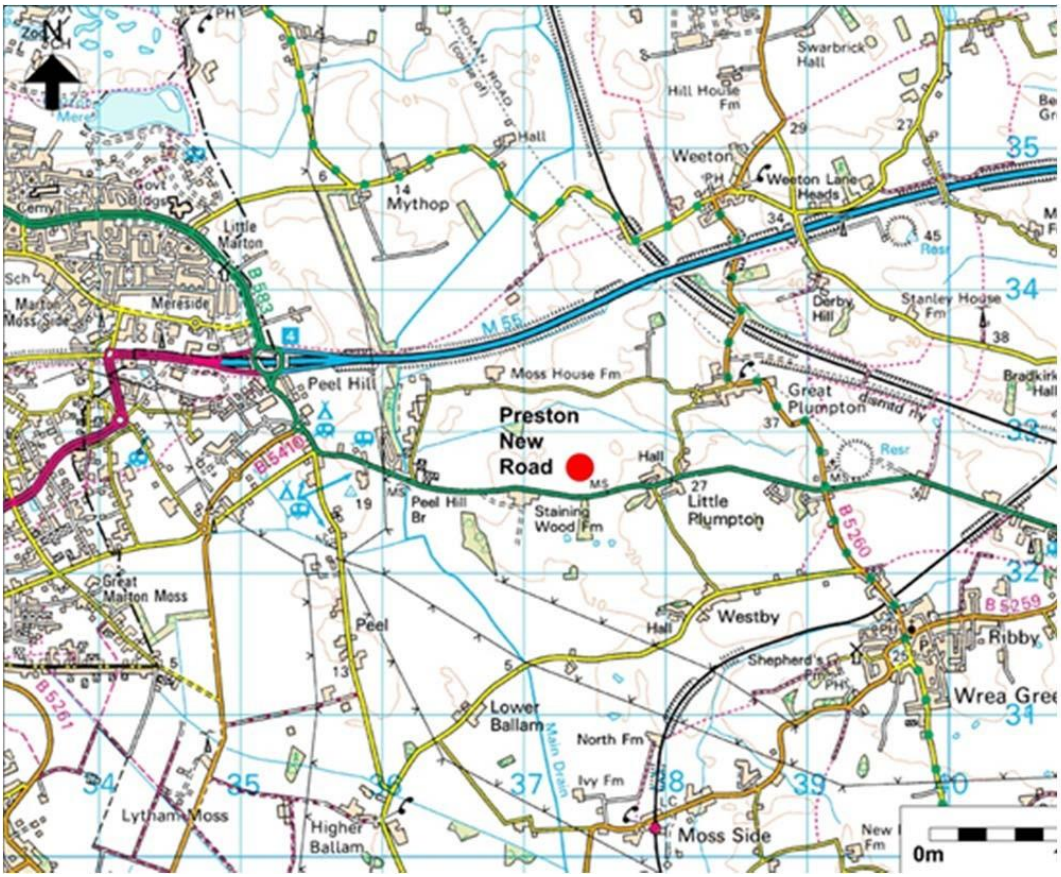
PART ONE

2.1.1 Socio-Economic Characteristics of Preston-New-Road

The Preston-New-Road site is equidistant between Kirkham and Blackpool on the South-West of Fylde coastal plain. It is located approximately 500m west of Little Plumpton village and about 1 kilometre west of Great Plumpton village. This section will allow readers to judge how similar (or different) Preston-New-Road may be to other areas when thinking about how these conclusions may relate to the UK in general. The site is strategically situated between Moss House Lane and Preston New Road (A583). It is about

2 kilometres east of M55/Preston New Road junction, i.e., junction 4. The national grid reference for the site is E337408, N432740. A wide context of the site is shown below:

Figure 2.1: Map of PNR fracking site. Contains Ordnance Survey data © Crown copyright and database right (2014) (Not to scale).



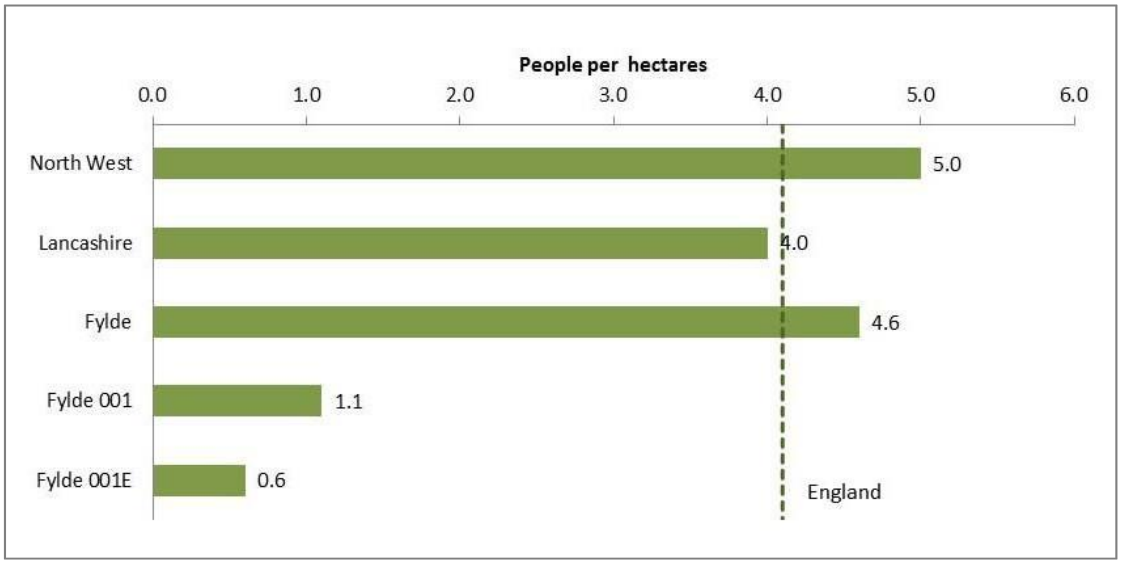
Moss House Farm is about 800 meters northwest of the site, on Moss House Lane's northern side. Staining Wood Farm is also located approximately 360 meters southwest of the site. 500metres southeast of the site is the village of Plumpton which has some residential properties. The village of Great Plumpton is also approximately 900 meters to the east of the site and has many residential properties. About 1,200 metres to the west at Carr Bridge is another residential area. In short, the Preston-New-Road hydraulic fracturing site is located near several residential areas.

2.1.2 Population

The Office for National Statistics (ONS) indicates that the nearest large settlement near Preston-New-Road is Blackpool, with a population of approximately 142,000. However, the population density near Preston-New-Road is relatively low compared with the surrounding areas.

2.1.3 Population Density

Figure 2.2: Population density bar graph from 2011 census. Source: Office for National Statistics.



The figure above shows that population density for the Lower Super Output Area and Middle Super Output Area is significantly lower than Fylde, Lancashire, North West region, and England. The Lower Super Output Area which the site sites have a lower population density of 0.6 per hectare.

2.1.4 Population Age

The figure below is a graphical representation of the selected geographical comparator's age profile based on figures from the 2011 census.

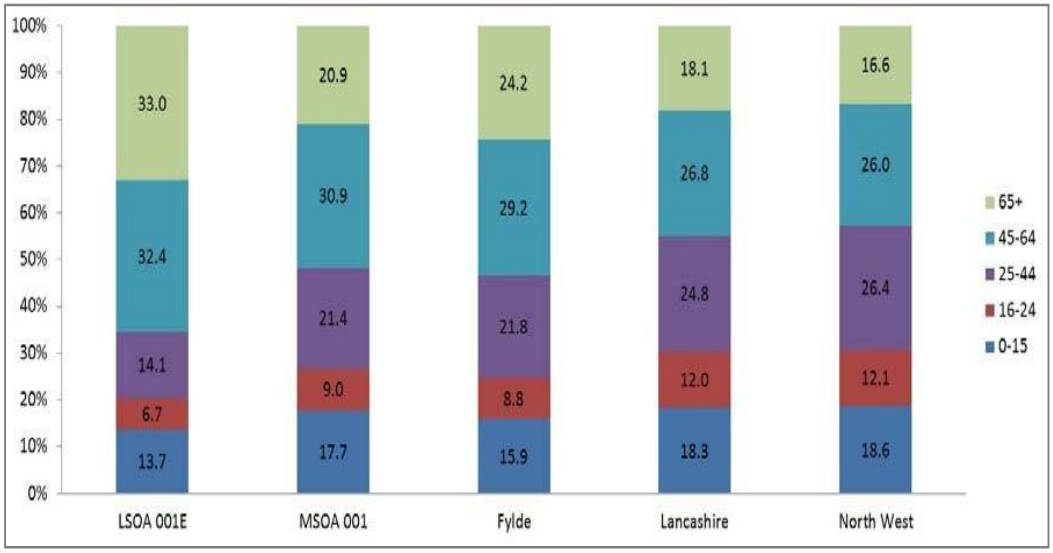


Figure 2.3: The age profile of selected geographical comparator from 2011 census. Source: Office for National Statistics.

LSOA[5] has the highest percentage (33%) of residents 65 years and over from all the other comparator areas from the above data. This percentage is 12.1% higher than MSOA, 8.8% higher than Fylde, 14.9% higher than Lancashire, and 16.4% higher than the wider North West area. LSOA also has a higher proportion of residents within 45-64 years, which is approximately 2-5% higher than the other comparator areas.

The higher percentage of over 65 years old residents in the area directly surrounding the site is an indication that the area has a lower proportion of young people. LSOA has a lower ratio of more youthful than 25 years of age compared with MSOA. Finally, the entire working class (people between the ages of 16-64 years) with no distinction for male and female are as follows: 53% in LSOA, 61% in MSOA, 60% in Fylde, 64% in Lancaster, and 65% in NW area.

[5] Lower Layer Super Output Areas

2.1.5 Population Projection

The projected population growth rates for the local and surrounding areas are shown on the graph below. The population of Fylde is projected to continue to grow into the 2030s much in line with the growth projection for Lancashire, the North West, and England

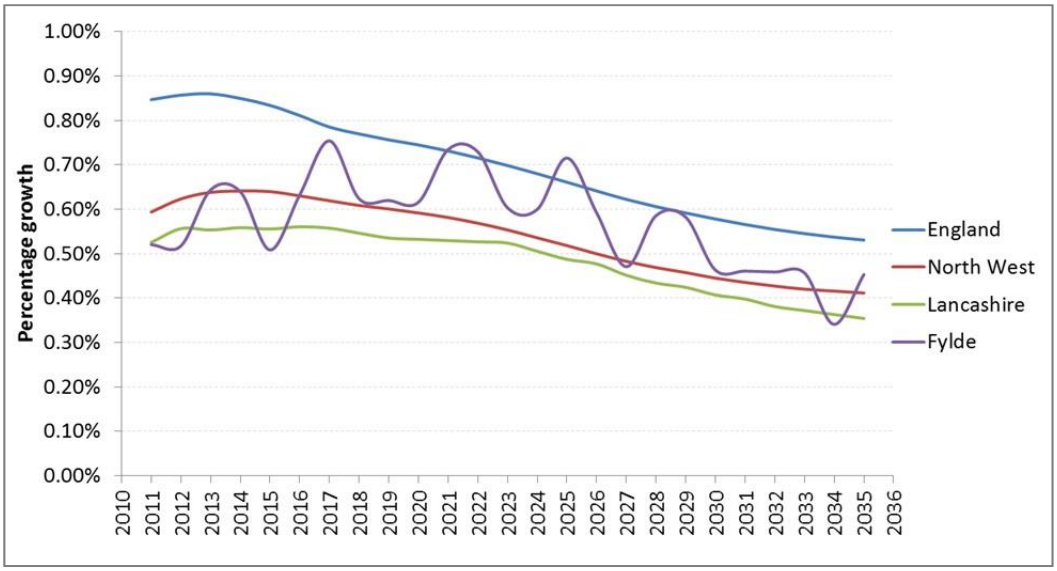


Figure 2.4: Population growth projection for selected geographic areas (Source: Lancashire County Council)

The rate of population growth of Fylde is projected to see an increase to around 2025. However, overall, the rate of population growth looks similar to Flyde, Lancashire, and England.

2.1.6 Geography

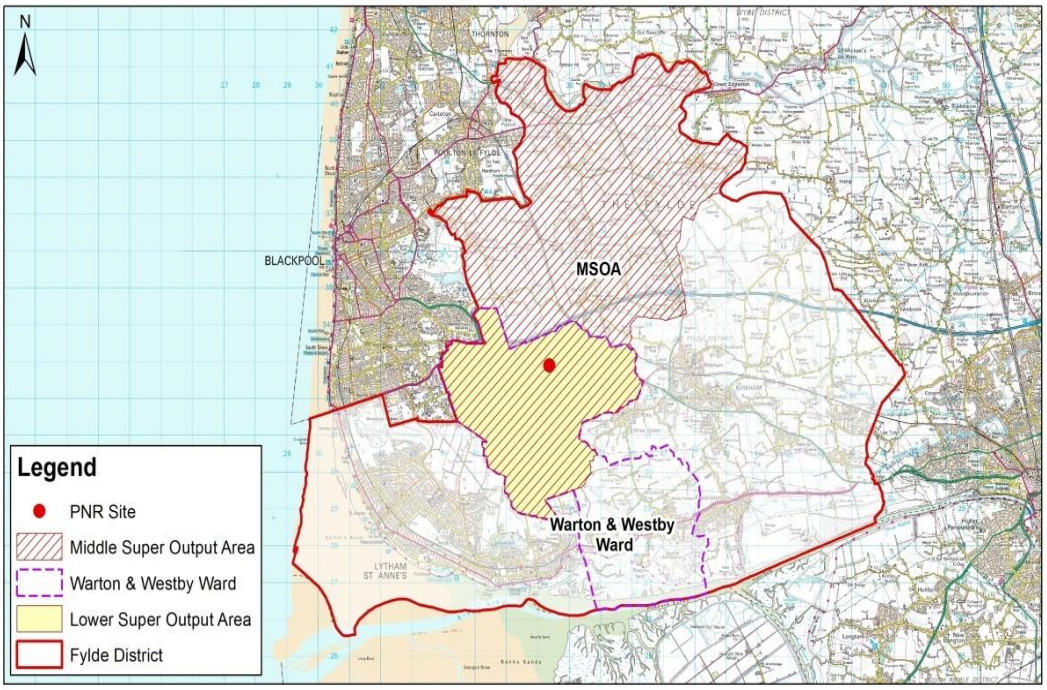
The Preston-New-Road site is located within Fylde, which is in Lancashire. The Fylde area contains 21 wards and 51 Lower Layer Super Output Area (LSOA). Technically, the site is situated within:

- Warton and Westby ward.
- LSOA 001E; and

- Middle super output area (MSOA) 001.

The figure below shows the Fylde borough (wider red line), the Middle Layer Super Output Area (MSOA)[6] (the red line and shaded area), and the LSOA (yellow area). Also shown is the Warton and Westby ward (purple). The Site sits within the Westby-with-Plumpton Parish (not mapped). Figure 2.1.6 below shows the Lower Super Output Area Fylde 001E (yellow area), Middle Super Output Area Fylde 001 (shaded area), and the Borough of Fylde (thick red line)[7]

Figure 2.5: Map of MSOA and Warton & Westby Ward (Contains Ordnance Survey data © Crown copyright and database right 2014)



Information from Flyde District Council indicates that Walton and Westby are one of nine rural wards and that one-third of the Flyde population live in the rural ward.

[7] Information and Image by courtesy of cuadrilla Resource Environmental Statement

2.1.7 Current Land Use and Surrounding Area

The hydraulic fracturing well studied in this thesis is located on an undeveloped greenfield site primarily for agricultural purposes. This area includes the well access track, well pad (where several boreholes can be drilled), and connection to the gas grid will be located. Several hedgerows, ponds, and small wooden areas are located around the vicinity.

The surrounding area of the proposed drilling work is located west of the borough of Fylde, which is rural and where lots of agricultural activities are taking place. The type of farming activities includes extensive arable and dairy farming and intensive market gardening. Communities located in the surrounding areas are situated on the map below

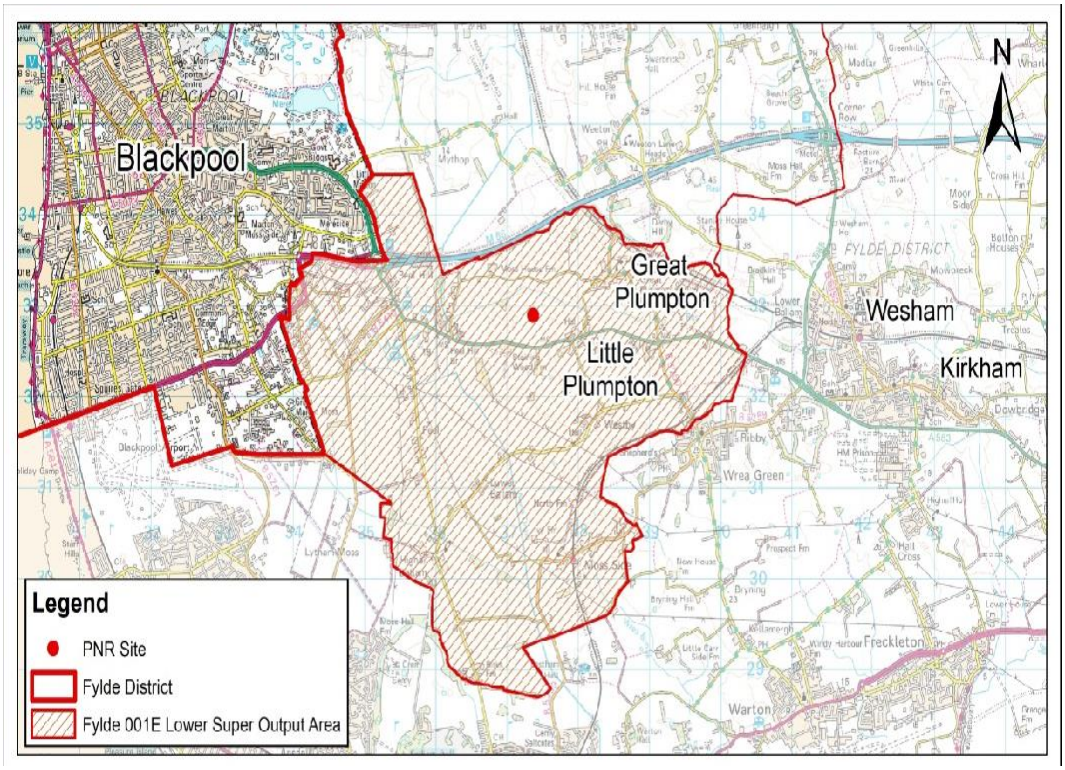


Figure 2.6: Map of Communities in the PNR surrounding area.

Small settlement areas are dispersed across the Fylde Plains. More densely populated areas are located to the west and south.

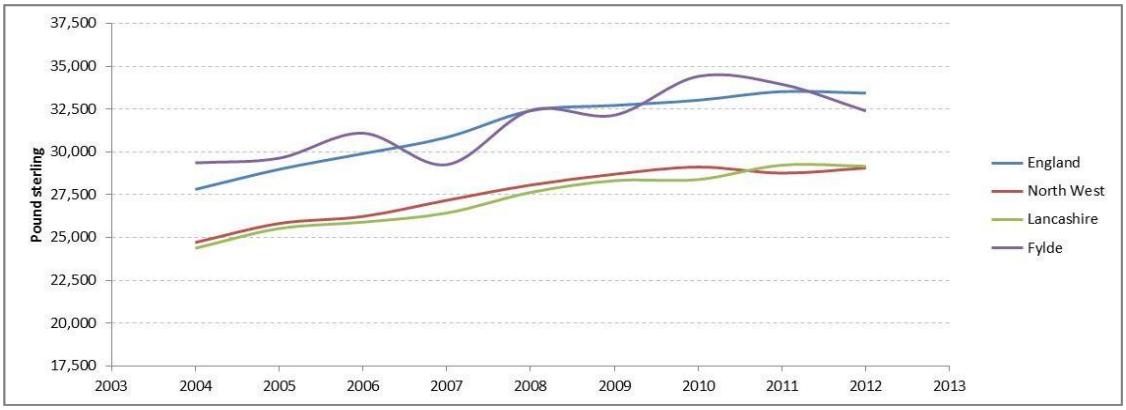
The site is situated almost directly between Blackpool (West) and Kirkham (East). Apart from the extensive agricultural activities, other several businesses operate within 1 km of the site, including:

- A garden central to the West
- A dog grooming business to the South
- A nursery garden located to the North West
- A cattery

2.1.8 Income

The mean gross annual income per full-time worker in Fylde has increased from an average of £29,000 in 2004 to £32,000 in 2012. Although higher fluctuation in mean income has been experienced in the borough, the increase rate is much in line with other comparator areas. The mean income level in the borough is similar to that in England, approximately £3,000 to £4,000 higher than that in Lancashire and North West.

Figure 2.7: Mean gross annual income per full-time worker (source: ONS).



For part-time workers, average wages have grown significantly in recent years in Fylde, when comparing point to point (i.e., 2009 to 2012). However, the level has

fluctuated considerably compared with three other comparators

2.1.9 Benefit Claimants

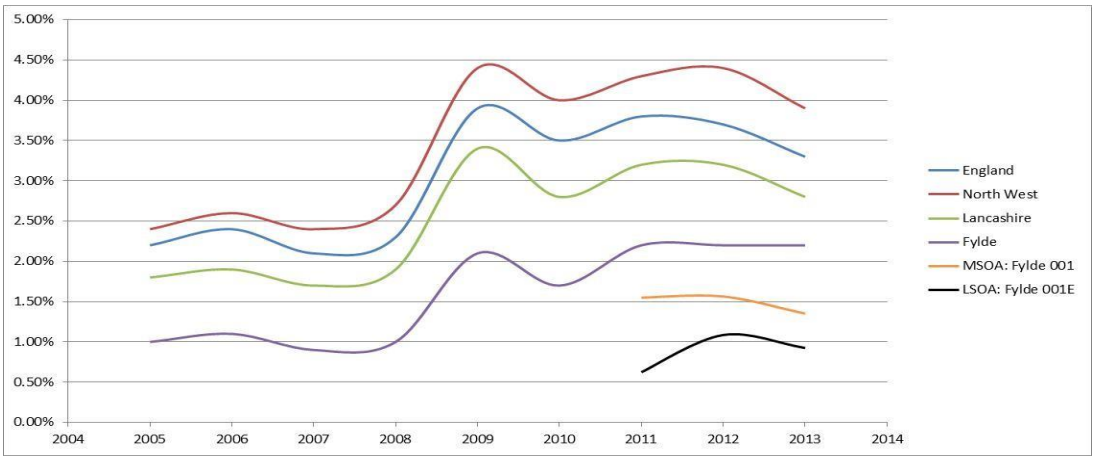


Figure 2.8: Percentage of the population claiming jobseekers allowance. Source: claimant count, mid-year estimates, ONS.

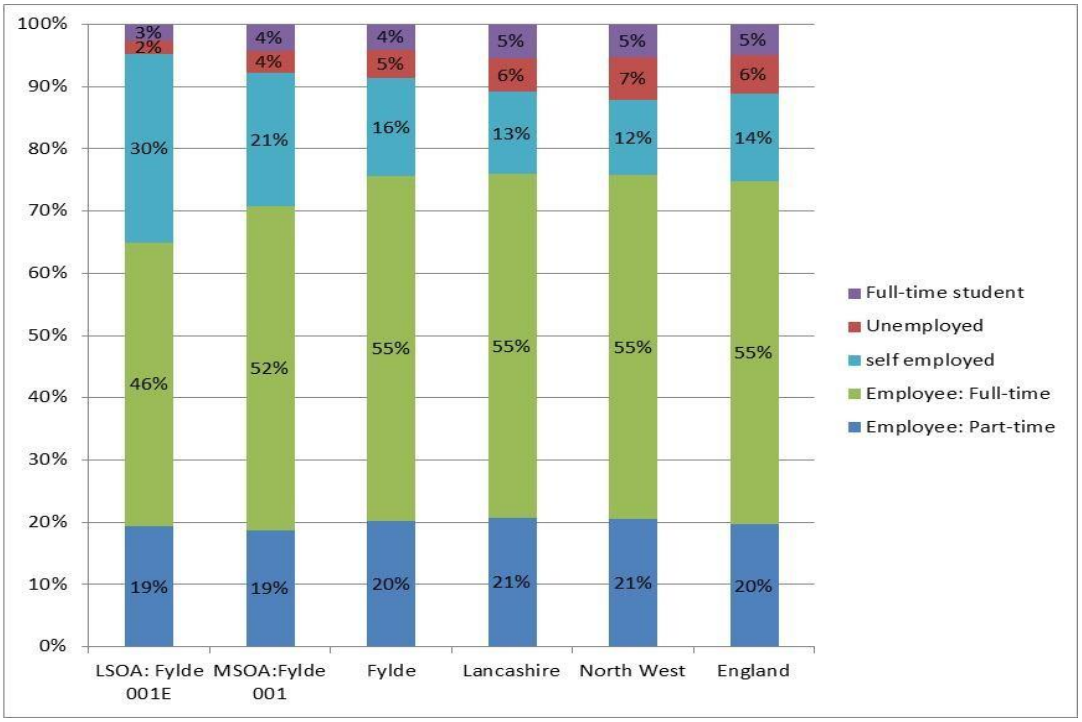
Figure 2.8 above shows the Claimant Count since 2004 for five comparator areas with only recent (2011 onwards) data demonstrated for the LSOA and MSOA. A significant increase in claimant numbers can be observed between 2008 and 2009 with a slight flattening out of the rate from 2010. In 2011 data for the LSOA and MSOA are available. Both have lower rates than the other areas shown. The MSOA is higher than the LSOA, with the gap closing over time as shown in figure 2.1.9 due to an initial sharp (but small) rise in the LSOA 2011-2012, and similar decreasing rates from 2012-2013. This rise in income occurred approximately three years before the operation of the Preston-New- Road well.

2.1.10 Economic Activity

Figure 2.9 below shows the economic activity rates and the employment rate for six comparator areas. The LSOA has the highest proportion of self-employed people at

30%. This is 9% higher than the next highest (Middle Layer Super Output Area, MSOA, 21%). This significantly higher percentage of self-employed people brings down the relative proportions of economically active people in the LSOA in every other category, to the lowest levels observed. LSOA around the site has the lowest observed level of unemployment (2%). The MSOA has a higher than average self-employed people and a resulting low amount of people classed as full and part-time workers.

Figure 2.9: Economic activity and employment rates (Source: ONS)



The proportions of full and part-time economically active people are similar across Lancashire, Fylde, the NW, and England with unemployment also following similar amounts (5-7%). The North West has the highest proportion of unemployed people (7%).

2.1.11 Employment by Industry

Figure 2.10 below shows the employment profile by the industry for six comparator areas. Of the six areas shown, most sectors show similar employment levels, as a proportion of all industries, with some exceptions.

The LSOA around the site has a larger proportion of residents employed in food production and services, agriculture, forestry and fishing, and construction. While the LSOA shows, the highest proportions observe. The MSOA around the site has relatively high employment rates in public administration and defence.

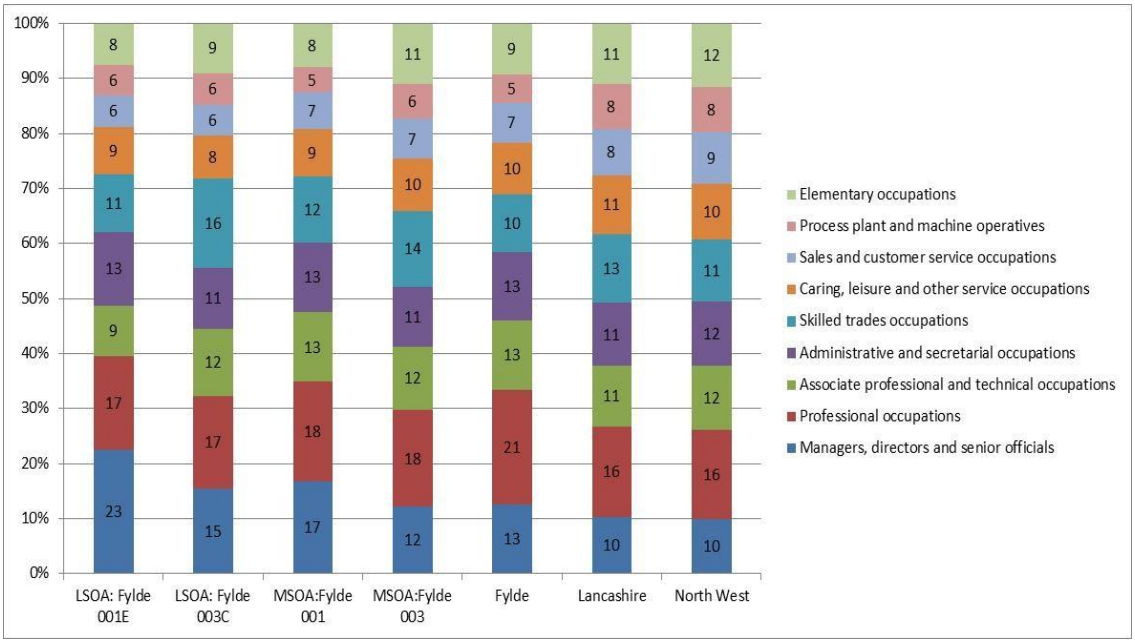
Fylde has 10% employment in this area. This type of job makes up 6-7% in the other comparator areas. Employment levels in construction are also slightly higher than in most other areas shown. Fylde has 10% employment in this area. This type of job makes up 6-7% in the other comparator areas.

Employment levels in construction are also slightly higher than in most other areas shown. The LSOA, MSOA and Fylde, have somewhat lower wholesale and retail trade; repair of motor vehicles and motorcycles employment, compared with Lancashire, the NW, and England (13%, compared with as high as 16-17% in some more expansive geographic areas).

The figure below shows the types of jobs people do for the same comparator areas. The main difference is that LSOA and MSOA have a relatively higher proportion of people employed as managers, directors, and senior officials

where 23% and 17% are employed in these roles respectively, compared with 10-11% for Lancashire, and England.

Figure 2.10: Occupation by job type for the comparator areas (source: ONS).



2.1.12 Deprivation

The Indices of Multiple Deprivation (IMD) is a multivariate indicator set produced by the government to aid and inform awareness of deprivation and approaches to improving deprived areas' conditions. The ONS holds data on this index. It states the following about LSOA areas (what it terms a neighbourhood). All 32,482 communities in England have been ranked on a range of deprivation topics. The most deprived community in England has a rank of 1. These markers show the overall deprivation and the environment deprivation ranking for the area. Compared with the region and national average, Fylde is 102 places higher than the North West average and 36 places higher than the national average.

The mapping overleaf shows that the LSOA where the site sits is in the mid to low region of overall deprivation. Fylde forms an integral part of the central Lancaster economy. It contains regionally significant business sectors, including the military aircraft industry (BAE system at Warton), and the nuclear industry (Westinghouse

nuclear processing plant at Springfields). The presence of these sectors means that the borough has a significant amount of high-value manufacturing.

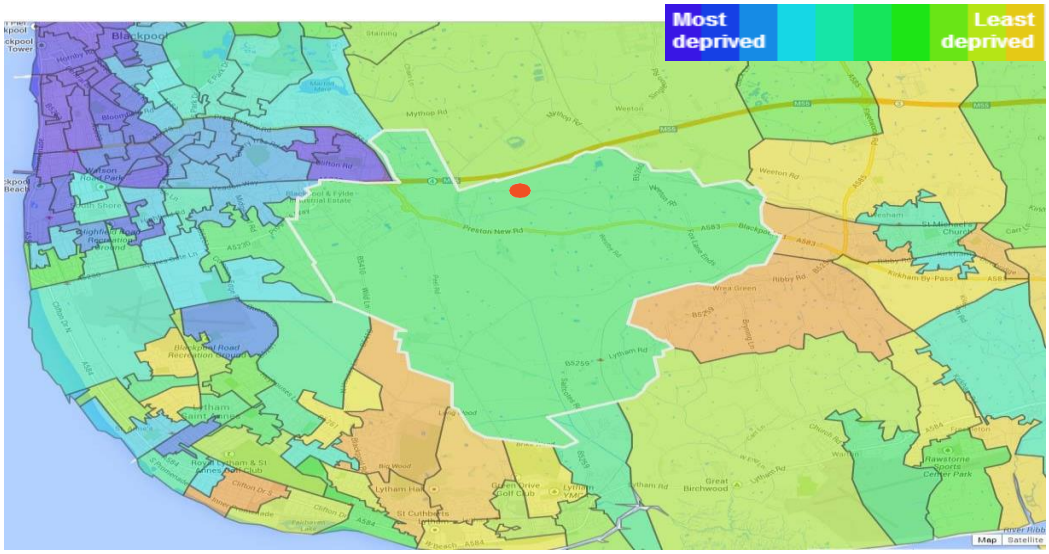


Figure 2.11: 2010 IMD rank mapping (image from http://opendatacommunities.org)

2.1.13 Housing

The low population density and ordinance survey mapping confirm comparatively little housing in the immediate surroundings. There are just over 35,000 houses across Fylde. Compared with the national average, Fylde has a much higher proportion of owner-occupied dwellings (80%, compared with 71%). The private rented stock is also at a higher level of 14% compared to 11% for England (see Table 2.1). Consequently, social housing is at a much lower level than is the case nationally.

Tenure	Fylde (dwellings)	Fylde (percentage)	England (percentage)
Owner occupied	28,490	80%	71%
Privately rented	4,910	14%	11%
Private sector	33,400	94%	82%
Housing	2,300	6%	-
Local authority	0	0%	-
Social housing	2,300	6%	18%

Table 2.1: Tenure profile of Fylde (Source: Fylde Borough Council)

The Five-Year Housing Supply Statement produced by Fylde Borough Council in March 2013 states that considering shortfalls since 2003; the adjusted housing requirement for the next five years would be 489 dwellings per annum. The council has identified an existing supply of 1,514 dwellings and a potential supply of 200 dwellings to meet this requirement. The current supply includes:

- Existing commitments.
- Planning applications approved subject to a signed Section 106 (if applicable) and planning applications minded to approve; and
- A deduction for planning applications that are no longer considered deliverable in accordance with NPPF paragraph 47.

2.1.14 Crime and Public Safety

The Fylde borough's crime levels are compared on the police website with other Most Similar Groups (MSGs – defined by socio-economic characteristics) and other regions in the Lancashire area. The results of the search showed the following:

- In the year ending 31 March 2013, the crime rate in Fylde was lower than the average crime rate across similar areas.
- In the year ending 31 March 2013, the crime rate in Fylde was lower than average for the Lancashire force area: and
- In the quarter ending 31 March 2013, crime rates were down in Fylde and the Lancashire force area compared with the corresponding quarter in 2012.

The nearest police stations are Kirkham, Blackpool, and Lytham. The closest, Kirkham, is approximately 5km to the East of the site.

Part one above discussed the geographical and social perspectives of the Preston-New-Road fracking site. This site is the primary focus of this thesis. Part two will discuss the history of onshore oil and gas in the UK, gas usage, and the political force that led to fracking's approval in Lancashire.

PART TWO

2.2.1 History of Hydraulic Fracturing Discovery and Development

While hydraulic fracturing is relatively new to the UK, it has been used extensively in the United States. The most significant recent impact in the US energy sector has been hydraulic fracturing (Stevens, 2012). In the US, shale gas extraction created about 600,000 jobs in 2010, added about $1,000.00 in disposable income per household, introduced higher paying jobs at about $23 per hour, and contributed about $77 billion to the nation's economy (Stevens, 2012) This drilling technique has enabled oil and gas companies to extract oil and natural gas from shale rock. Many myths surround this technology, and the biggest myth is that this is a novel technology (Manfreda, 2015).

The discovery and history of fracking can be traced back to 1862 during Fredericksburg's battle where civil war veteran Edward A. L. Roberts saw what could be accomplished when firing explosive artillery into a narrow canal that obstructed the battlefield. On April 26th, 1865, Edward Roberts received his first patent for an "improvement" in exploding torpedoes in artesian wells (Manfreda, 2015). In November of 1866, Edward Roberts was awarded patient number 59936, known as the 'Exploding Torpedo' (Manfreda, 2015).

This extraction method was implemented by packing a torpedo in an iron case that contained 15-20 pounds of powder. The case was then lowered into the oil well, at a spot

closest to the oil. From there, they would explode the torpedo by connecting the top of the shell with wire to the surface and then filling the borehole with water.

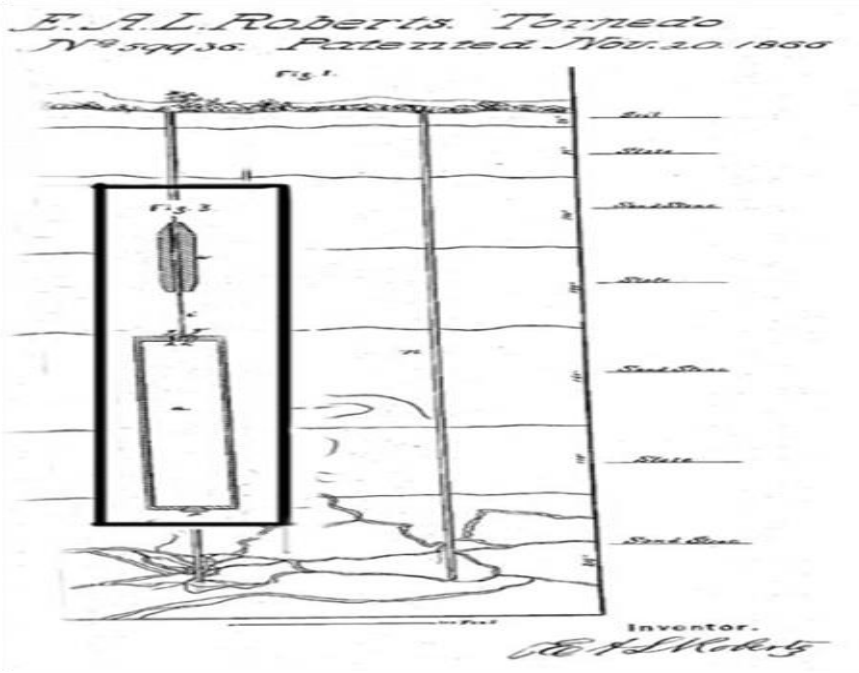


Figure 2.12: A diagram of Edward A.L. Roberts's torpedo (Manfreda, 2015).

This invention increased oil production by 1200 percent from certain wells within a week of being implemented. This also led to Roberts Petroleum Torpedo Company's founding, which charged $100 - $200 per rocket, plus a royalty of 1/15 of the profits generated from the product.

2.2.2 Commercial Hydraulic Fracturing

The first form of hydraulic fracturing innovation didn't occur until the 1930s, when drillers used a non-explosive liquid substitute called acid, instead of dynamite or nitroglycerin detonation (Logan et al., 2012). The acid made wells more resistant to closing, thus increasing productivity. Even though hydraulic fracturing began in the 1860s, modern-day hydraulic fracturing began in the 1940s (Logan et al., 2012). In 1947, Floyd Farris of

Stanolind Oil and Gas began a study on the relationship between oil and gas production output, and the amount of pressurized treatment used on each well.

Floyd Farris's study led to the first experiment of hydraulic fracturing, which occurred at the Hugoton gas field, located in Grant County, Kansas, in 1947 (Charlez, 1997). In this experiment, 1,000 gallons of gelled[8] gasoline and sand were injected into a gas-producing limestone formation with a depth of 2,400 feet.

The experiment was not so successful because the deliverability of the well did not change appreciably. The process was further described by J.B. Clark of Stanolind in his paper published in 1948 (Charlez, 1997). A patent on this process was issued, and the exclusive license was granted to the Halliburton Oil Well Cementing Company. On March 17, 1949, Halliburton conducted two commercial experiments; one in Stephens County Oklahoma, and another in Archer County, Texas (Montgomery & Smith, 2010).

After achieving experimental success in 1949, fracking quickly became commercialized in the United States. In the 1960s, Pan American Petroleum began using this drilling technique in Stephens County, Oklahoma. In the 1970s, this extraction method was used in the Piceance Basin, the San Juan Basin, the Denver Basin, and the Green River Basin. This widespread use even garnered the attention of President Gerald Ford. In his 1975 state of the union address, President Ford promoted the development of shale oil resources, as part of his overall energy plan, to reduce foreign oil imports (Rapier, 2012). This theme of using shale gas to reduce imports and increase national security is one that we see in modern-day justifications for expanding shale gas in the UK (Rapier, 2012).

[8] Gel point is the temperature at which diesel or biodiesel fuel freezes solid and can no longer flow by gravity or be pumped through fuel lines. This phenomenon happens when a fuel reaches a low enough temperature whereby enough wax crystals have formed to prevent any movement in the oil.

Afterwards, an engineer of Devon Energy (Formerly Mitchell Energy), George P. Mitchell applied a technique known as the 'slickwater fracturing technique' for the first time in 1997 at North Texas Barnet Shale. This method used a higher quantity of water and higher pressure than usual (Zuckerman, 2013). This method also proved beneficial because the amount of gas from this well (known as S. H. Griffin No. 3) exceeded all other wells in the US (Gold, 2014; Zuckerman, 2013). This fracking technique has received worldwide recognition and is now used in various parts of the US, Australia, Canada, and China. The extraction of unconventional natural gas has grown since 1990. This growth has mostly been attributed to the recent change in drilling technology (i.e., hydraulic fracturing). Most of these developments are in the USA where there have been significant policy promulgation and implementation to position the country as 'self-sufficient' when it comes to energy (Brasier et al., 2011; Gunter et al., 1997).

The drilling boom that started in the late 1990s has led to considerable controversy because of hydraulic fracturing's perceived risk (Negro, 2012). The debate generated by hydraulic fracturing was likely fuelled by a 2010 documentary film, *Gasland* directed by Josh Fox. This film explored the challenges of residents of Colorado, Wyoming, Utah, Texas, and other states where hydraulic fracturing was underway. Gasland producers attributed contamination of water and air and various chronic health problems to hydraulic fracturing. These allegations have been challenged by the State of Colorado's Department of Natural Resources, especially on the assertion that fracking can cause tap water to become flammable.

Notwithstanding the challenge, the film stirred controversy and generated media attention considerably. Another movie was released in the US entitled *Promised Land* for general screening on 28th December 2012, which ignited the fracking debate in the US and UK (Sant, 2013). In the Promised Land, a salesman for a natural gas company experienced life-

changing events after arriving in a small town, where his corporation wants to tap into the available resources. The film depicts a real conflict within communities confronted with the decision about money for the present versus the probability of environmental damage in the future.

The extraction of this gas occurs in many countries, such as the US, India, China, Australia, and Canada. The following countries have the potential to extract shale gas; Brazil, Austria, Norway, Germany, Sweden, Turkey, Poland, Argentina, United Kingdom, and Romania (Ross & Bustin, 2007; Schulz et al., 2010; Selley, 2005; Weijermars, 2013; Wiśniewski, n.d.; Wright, 2012). The rapid growth in this sector is due to global energy demand and the quest to meet or satisfy this demand (Kerschner et al., 2013). Shale gas is already extracted at an advanced stage in the Marcellus and Barnet shales of the US. Unconventional natural gas extraction is still in its exploratory stage in the UK.

Sections 2.2.1 and 2.2.2 have discussed the global history of oil and gas. The next section will focus on the history of oil and gas in the U.K., the jurisdiction of this thesis. The political will and legal process that led to fracking's final approval in the UK will also be discussed.

2.2.3 History of Onshore Oil & Gas in the UK.

The onshore exploration of oil and gas in the UK can be traced back to the 1850's. Before the First World War, the country's total petroleum requirement was 50,000 barrels per day, and this was supplied exclusively via imports. The first domestic supply of oil and gas started in 1851 in the Midlands Valley of Scotland. At its peak in 1913, it reached an average production of 6,000 barrels of oil per day, continuing until 1962 (UKOOG, 2013). The earliest report of hydrocarbons in Southern England was in 1836 and 1875 where gas was detected in water wells in the Sussex area.

In 1895 and 1896 at Heathfield in Sussex, Wells drilled to provide water for a hotel, and railway stations also encountered gas. The railway station well reached Kimmeridgian strata[9], with a strong gas odour noted. On ignition, it produced a 5-meter-high flare. The well became Britain's first natural gas well, with a production of 1,000 cubic feet per day (cfd) used to provide gaslight for the station (UKOOG, 2013). With the First World War, a secure oil supply became more critical, with oil requirements doubling in 1916 and 1917. As a result, the UK Government introduced legislation, the Petroleum Act 1918, which prohibited exploration and production other than by the Crown, or under license from the Crown.

The first oil in England was discovered in Hardstoft, Derbyshire in 1919. Despite the 1918 legislation, only 11 wells were drilled between 1918 and 1922 with only one discovery proving commercial. In 1934, the Government promulgated the second major piece of legislation, The Petroleum (Production) Act 1934, which gave petroleum ownership to the Crown, and limited surface owner rights. In 1935, the first licenses were introduced and given to four companies. Exploration started in 1936, and the first commercial discoveries came in 1937 (UKOOG, 2013).

During the Second World War, drilling was carried out in Nottinghamshire to support the war effort. This is celebrated by the 'Oil Patch Warrior' memorial at Dukes Wood. Up to 1964 in the UK, there were 25 discoveries of which seven were gas fields. Production rose to around 3,000 barrels per day. In the ten years to 1964, imports on average increased by

[9] The Kimmeridge Clay is a sedimentary deposit of fossiliferous marine clay which is of Jurassic age and occurs in Europe. This rock formation is the major source rock for North Sea oil. The fossil fauna of the Kimmeridge Clay include turtles, crocodiles, sauropods, plesiosaurs, pliosaurs and ichthyosaurs, as well as a number of invertebrate species (Gallois & Cox, 1994).

an annual 8.5% and were putting a considerable strain on the balance of payments (National Gas Museum, 2018).

The UK's interest in offshore exploration started with the gas discoveries in the Netherlands in 1959, and this led to the UK Continental Shelf Act in 1964, essentially making petroleum rights the same both onshore and offshore. Also, in 1964, new offshore licenses were created. Onshore oil production was dominated by the discovery, in 1973, of the Wytch Farm Oilfield in Eastern Dorset. This oilfield, the largest onshore in the UK. by several orders of magnitude, was discovered after a phase of seismic reflection surveying in 1970 and early 1971. The first hydraulic fracture in the UK was performed in the mid to late sixties (National Gas Museum, 2018).

Onshore activity once again started to accelerate after the 1979 increases in oil price. The first onshore licensing round was announced formally in June 1985. It included changes made in the Petroleum (Production) (Landward Areas) Regulations 1984 (UKOOG, 2013), which among other things included the requirement for the first time to have local planning permission. The Petroleum Act of 1998 vests all rights and ownership of hydrocarbons resources to the Crown. On 28 May 2008, the Department of Business Enterprise, and Regulatory Reform (BERR) offered 93 new licenses to 54 companies, under the 13th Onshore Licensing Round. In addition to conventional oil and gas, applications were received for coal bed methane, coal mine methane, and shale gas (Clark et al., 2012; National Gas Museum, 2018).

In June 2013, The British Geological Survey (BGS) in association with the Department of Energy and Climate Change (DECC) completed an estimate for the resource (gas-in-place) of shale gas in part of central Britain in an area between Wrexham and Blackpool in the west and Nottingham and Scarborough in the east. The central estimate for the resource

was 1,300 trillion cubic feet (tcf). This compares to the annual consumption in the UK of just over 3 tcf. Around 2,000 wells have now been drilled onshore in the UK with about 10% of them having been hydraulically fractured. There are currently around 120 producing sites with 300 operating wells producing more than 20,000 barrels of oil equivalent per day or about 1% of the UK's consumption (UKOOG, 2013).

Sources of Natural Gas in the U.K.

Oil and natural gas provide the raw material to make a wide range of products. It is nearly impossible to get through a day without using multiple products that contain oil or gas. Shampoo, toothpaste, contact lenses, shaving foam, lipstick, washing powder, and clothing all have petroleum products. Natural gas is also the raw material for plastics, a material found everywhere from personal electronics, such as mobile phones and computers, to safety equipment, including bicycle helmets and airbags, to sterile medical equipment (Verhallen et al., 1981).

UK-sourced natural gas production has come predominately from the North Sea since the early 1960s, but this supply has decreased since 2000. In 2012, production was down 14% compared with 2011 to 452 Terawatt hours (TWh). Imports of Liquefied Natural Gas (LNG) have risen from 9 TWh in 2008 to 271 TWh in 2011.

In 2012 demand for LNG in Asia led to LNG imports to the U.K. falling by almost half to 148 TWh as cargoes were diverted. With overall imports during 2012 at a record high, net import dependency climbed to 43%, its highest level since 1976 (UKOOG, 2013).

Sources of U.K. Gas Imports	
Pipeline Norway	55.1%
LNG Qatar	27.0%
Pipeline Netherlands	14.6%
Pipeline Belgium	2.7%
LNG Norway	0.3%
LNG Algeria	0.2%
LNG Nigeria	0.1%

Table 2.2: Sources of Gas imported by the U.K. (UKOOG, 2013)

2.2.4 Political Force that led to the Approval of Hydraulic Fracturing in Lancashire

On 1st April and 27th May 2011, two earthquakes of magnitude 2.3 and 1.5 respectively, were detected in the Blackpool area. These earthquakes were immediately linked to hydraulic fracture injection at the Preese Hall well operated by Cuadrilla Resources Ltd. This well was hydraulically fractured during the exploration of a shale gas reservoir in the Bowland basin. These earthquakes caused the UK government to put a moratorium on fracking. Cuadrilla Mining Resources Ltd commissioned several studies into the relationship between the earthquakes and their operations (British Geological Survey, 2011; Clarke et al., 2014).

Cuadrilla carried out six hydraulic fracture treatments at different depths, and seismicity was observed during stages 2, 4, and 5. The enormous 2.3 magnitude earthquake occurred approximately 10 hours after shut-in following stage 2 treatment, and the 1.5 magnitude earthquake also occurred roughly the same period after stage 4 (Green et al., 2012). The onus was placed on the industry to prove that fracking can be done without causing harm and having enough safeguards in place. An influential report by the Royal Society and Academy of Engineering (Bickle et al., 2012) followed thereafter by an industry investigation of seismic risk factors (Green et al., 2012). This report led the government to

recommend that shale gas extraction can be managed in the UK if best practice regulatory safeguards are put in place (Cotton, 2017).

The Health and Safety Executive (HSE) regulations require an independent and competent person to be appointed to examine the well's design and construction before drilling starts. The operator must notify the HSE of the well's design and operation at least 21 days before drilling is due to start. Operators must also notify the environmental regulator of their intentions and meet all baseline monitoring requirements set out to plan permission and environmental permit before drilling begins. During drilling, the HSE monitors well operation to ensure legal duties are carried out satisfactorily. The HSE specialist also ensures construction matches the design by reviewing the weekly operations report it receives from the well operator (Department of Energy and Climate Change, 2014). Critics have argued that this technical approach to managing risks associated with fracking is favoured by policymakers, but lacks wider stakeholder and public consultation (Williams et al., 2015).

The lack of epidemiological evidence of the long-term public health risks associated with fracking makes fracking policy challenging to craft for governments. The local government took a precautionary approach in response to this lack of evidence, as protecting the public from serious harm from potential environmental risks from fracking takes precedence over enhancing its welfare through economic regeneration (de Melo-Martín et al., 2014). Nevertheless, the government lifted the moratorium on fracking in December 2013. The government mobilised to promote industry expansion through a policy platform described by Prime Minister David Cameron as 'going all out for shale' (Watt, 2014). The 'all-out for shale' implied that shale gas was beneficial for job growth creation and energy security.

The ‘all out for shale’ strategy began under the former Conservative and Liberal Democrat Coalition Government. They introduced specific policy mechanisms to stimulate development through tax breaks for industry and local councils and benefit communities through profit-sharing measures and compensation. They also promise to promote local employment, to streamline applications for consent by pushing for fracking-related planning reform (Cotton, 2017). The UK government sought to convince local communities and the general public that fracking in the UK is different from the U.S. in that it will not lead to environmental harm and adverse human health outcomes. David Cameron noted, “What I would say is recovering unconventional gas will only go ahead with stringent environmental safeguards…I hope that reassures people there is no danger of some dash into technology without the safeguards in place and real payback for local people, in terms of the Community Payback scheme” (Blackpool Gazette, 2015).

2.2.5 Speeding up Hydraulic Fracturing Decisions in England

Shale gas production has expanded across the globe, and the UK is no exception. On May 17th, 2018, ministers announced plans of considering taking fracking decisions in England out of the hands and control of local authorities and allowing shale gas exploration wells to be drilled without the need for planning application as was the norm (Hayhurst, 2018).

The statement issued by the Energy and Local Government Secretaries (Hayhurst, 2018) further stated that there would be a consultation to treat hydraulic fracturing applications as National Significant Infrastructure Project (NSIP). NSIP is large-scale developments relating to energy, transport, water, and waste, which requires a type of consent known as development consents. Development consents automatically remove the need to obtain several separate consents, including planning permission, which is designed to be much quicker than applying for them separately (Smith, 2017). In this regard, planning

applications for hydraulic fracturing schemes would be decided by a government-appointed inspector, rather than the local planning authorities (Hayhurst, 2018).

In line with this, the UK government is also setting up a single shale gas environmental regulator. This was released by ministers Greg Clark and James Brokenshire (Hayhurst, 2018). This would bring together the Environment Agency, Health and Safety Executive, and Oil and Gas Authority. The minister said:

> We believe that it is right to utilize our domestic gas resources to the maximum extend and exploring further the potential for onshore gas production from shale rock formation in the UK, where it is economically efficient, and where environment impacts are robustly regulated, and further added that We also see an environmentally robust onshore shale gas sector- and to explore opportunities from this model, a core theme of our modern industrial strategy (Hayhurst, 2018, p2).

The shale gas industry welcomed these announcements. Opponents have argued that this would pervert the planning process and represented an assault on communities' abilities to influence decisions.

The decision to speed up hydraulic fracturing in England as announced by the UK government has generated diverse views and debates among industry players and stakeholders. The opposition to fracking in England is essential because of its adverse impacts on groundwater pollution, risks of localized earthquakes, localized noised and traffic congestion, destruction of natural beauty, and planning blight on local communities. Daniel Carry-Dawes, a Senior Infrastructure Campaigner for Campaign to Protect Rural England, stated his frustration with the governments' decision. His concerns were related to health, landscape, and the environment. He stated that:

> This announcement signals an outright assault on local communities' ability to exercise their democratic right in influencing fracking application. It reads like a wish list from the fracking companies themselves. The government may want to provide 'sweetness' for

> communities affected, but nothing will change the fact that this will be a bitter pill to swallow. Simplifying the shale gas application and exploration process will have disastrous effects for the health and tranquility of our countryside, landscapes and environment. Our countryside is the breathing space for us all- it must not become an industrial testing ground for a fracking industry that has no environmental, economic, or social licence (Hayhurst, 2018, p2).

An active organization that opposes fracking in the UK is Greenpeace. Rebecca Newsome, Head of Politics at Greenpeace UK, also voiced out her frustration that the government is taking away local communities' control from the locals. She stated that:

> After seven years of fracking doing less than nothing to help our economy, the government's still going all out for shale and still trampling over democracy to prop up this collapsing industry. Communities and their local councils across the UK have said no in every way they can, but the government have turned a deaf ear to everyone who doesn't own fossil fuel company. In their commitment to extract more gas than we can afford to burn, they are trying to remove planning control from everyone who understands their local area and make exploratory drilling as easy as building a garden wall or conservatory (Hayhurst, 2018 p3).

A vibrant anti-fracking movement, Frack Free Lancashire released a statement and stated that:

> This ministerial statement shows that the government is prepared to ride roughshod over local democracy. It is hopelessly conflicted over its climate change obligations and is relying on magical thinking about non-existing Carbon Capture and Storage to justify its capitulation to the shale gas lobby. Dr. Frackensteins sticky monster is lying on the operating table and the government is trying to jolt some life into it in spite of huge national opposition and a growing number of scientific evidences against fracking. 79% of the UK public support renewable energy, whereas only a measly 18% support fracking. It can only end badly; either for us or for them (Hayhurst, 2018, p4).

The shale gas industry welcomed the UK government's statement and reiterated the importance of fracking in England. The 2013 report of the British Geological Survey states that Britain is sitting on a shale gas deposit that could supply the UK for 25 years (British

Geological Survey, 2013). They suggested that an area stretching from Lancashire to Yorkshire and Lincolnshire could hold at least 1,300 tcf of gas.

Supporters of fracking in England, including the gas companies, point to several advantages, including energy supply security. Shale gas exploration is critical if the UK rebalances its economy away from services and reliance on the financial sector. This is because manufacturing uses more energy, and in this unstable world, it is crucial to focus on the UK's energy resources. Fracking will also provide the UK diversity of energy supply, and a relatively clean energy source (Last, 2016). Francis Egan, Chief Executive of Cuadrilla Mining Resources, welcomed the news from the UK government and stated that:

> We very much welcome the Government's announcement today highlighting the national importance that shale gas development has in delivering a safe and secure energy source whiles meeting the country's climate change obligation. We are pleased it is recognized, as we our self are providing in Lancashire, that shale gas can and does deliver important economic benefits. In the last two years our exploration operations are responsible for driving almost £9m into the Lancashire local economy and creating 60 local jobs. In particular we welcome the measure the government has introduced on making the process faster and fairer and providing additional resources to help local authorities. Our planning permission to drill and test just four shale gas exploratory wells in Lancashire was grated after a lengthy and costly three years process. These timelines must provide if the country is to benefit from its own, much needed, indigenous source of gas (Hayhurst, 2018, p4).

Ineos Shale is also an active gas company expected to start fracking for the next five years in the UK in their statement stated that:

> We have been discussing these issues with the government, and we appreciate they have taken our concerns seriously and move quickly to begin to address the issues preventing the UK accessing its own gas. The government's announcement today that they will review the planning processes regarding shale is a step in the right direction and there is much more that needs to be done. We will work with government to try and help them put in place a regulatory environment that makes a UK onshore gas industry both safe and commercially sustainable. The UK planning system

> has been targeted by environmental activist, leaving local planning authorities reluctant to allow any shale-related activities. The vast majority of applications are turned down, even where council officers have recommended, they should be approved. In other words, such decisions are political, not evidence based. Every application defeated by anti-shale activist simply means more important gas from foreign countries. By 2030 th UK is forecast to be importing 72% of its gas, with much of this coming from Russia and the Middle East. Environmentalists believe that UK shale gas is bad for the environment, but such thinking is misconceived. The Mackey and Stone report showed that UK shale gas wells drilled over the next 20 years could save 117 million tons of CO2 compared to the UK being reliant on LNG imports. Environmentalists want us to abandon fossil fuels altogether, but that simply won't be possible for several decades. renewable energy from wind and solar is easily and regularly disrupted by 'acts of god' - basically the wrong kind of weather. Wind farms are notoriously unreliable, typically only operating at 30% capacity. The UK also has an extremely limited ability to store energy. If the UK wants to continue to have electricity, lightning and heating available 100% of the time, it simply cannot rely on renewable (Hayhurst, 2018, p5).

Final Approval of Hydraulic Fracturing

The UK government on the last day of its sitting on 24th July 2018 before the summer break approved fracking at the Preston-New-Road site (Cockburn, 2018). After the energy minister Claire Perry said she was satisfied, Cuadrilla Mining Resources has met all the requirements for a permit. According to Ms. Perry:

> Shale gas has the potential to be a new domestic energy source "further enhancing our energy security and helping us with our continued transition to a lower-carbon economy and it also has the capacity to deliver substantial economic benefits, nationally and locally, as well as through the creation of well-paid, high-quality jobs (Cockburn, 2018, p2).

She stated that the UK has an already excellent, long-standing reputation for safe oil and gas exploration. And the country's "world-class regulations will ensure that shale exploration will maintain robust environmental standards and meet the expectations of local communities" (Cockburn, 2018, p2). She made this decision after an assessment by the Health and Safety Executive and the Environmental Agency.

This decision to approve fracking, however, ignored the recommendations of the National Infrastructure Commission (NFC). The NFC is an independent government adviser. In a major report in June 2018, the NFC warned that the U.K. could not achieve its emissions target by relying solely on natural gas and advocated for ministers to seize the opportunity to move the UK towards greener energy without increasing consumer bills (Cockburn, 2018).

This decision to give final approval to fracking has attracted responses from various stakeholders and Non-Governmental Organizations. Jonathan Bartley, co-leader of the Green Party, wrote on Twitter: "This announcement has been snuck out on the last day of parliament. In the middle of a global heatwave the government is kick-starting a new fossil fuel industry. It should hang its head in shame." (Cockburn, 2018, p2)

Cuadrilla Mining Resources, welcomed the news, and its Chief Executive, Francis Egan, said:

> We are very pleased to be the first operator in the UK to have been awarded final consent to hydraulically fracture the UK's first onshore horizontal shale exploration well. This is a testament to, and underpinned by, our strong track record of running a world class shale gas exploration site at Preston New Road, in compliance with robust health, safety, environmental and planning regulations (Cockburn, 2018, p4).

He added that the company would be submitting a consent application for a second well at the Preston-New-Road site. Friends of the Earth UK has criticized the approval decision, and its director of campaigns Liz Hutchins said:

> It had taken seven years for the industry to get to this point, during which time renewable had gone from supplying a tenth of the UK's electricity to a third. There is no need to force fracking on this community in Lancashire when the alternatives are so clear (Cockburn, 2018, p4).

This section examined the political will that led to the eventual approval of fracking in England and Lancashire. I also looked at the policies that were put in place to ensure the fair distribution of fracking resources. The next section briefly discusses the mining company engaged with fracking and their activities in Lancashire.

2.2.6 Cuadrilla Mining Resources

This research focuses on the psychosocial impacts of hydraulic fracturing in the UK with a specific focus on the Preston-New-Road site (also known as Little Plumpton site) of Cuadrilla Resources. This section will briefly discuss the gas company, Cuadrilla Mining Resources, and its operations in Lancashire and elsewhere.

Cuadrilla Mining Resources is an oil and gas exploration and company founded in the year 2007. Their headquarters is in Bamber Bridge, Lancashire, United Kingdom (Lucas Group Limited, 2018). It has operations in the United Kingdom and abroad. The company is financed with investment from an Australian engineering company A. J. Lucas and an Anglo-American equity firm Riverstone Holdings. A.J. Lucas holds a share of 47%, Riverstone Holdings holds a share of 45%, and Cuadrilla employees (including former employees) holds the remaining 8% (AJ Lucas Group Limited, 2018). Roy Franklin chairs the company. Roy is also the Deputy Chair of the board of Star Oil ASA. The Chief Executive of the company is Francis Egan (AJ Lucas Group Limited, 2018). The company plans to develop shale gas in the UK by using hydraulic fracturing techniques.

Cuadrilla's activities caused two earthquakes in April 2011 when they fracked the Preese Hall site[10] on the Fylde in Lancashire. Their attempts to frack at Balcombe in 2013 were met with strong resistance, which forced the company to back down. Efforts to pursue

[10] The Preese Hall site is one of the fracking sites in Lancashire, England.

fracking on the Fylde have continued, and local opposition has continuously opposed their operations. After their application to drill shale gas at the Preston-New-Road site was initially turned down by Lancashire County Council, Cuadrilla appealed. In October 2016, Communities Secretary Sajid Javid overturned the Lancashire County Council's decision, giving the company approval to frack.

Construction of the site began in January 2017. Cuadrilla began exploratory drilling in the Preston-New-Road area. However, the community's daily roadside resistance and a series of direct actions have impeded work on the site. In July 2017, a direct grassroots action called, Reclaim the Power, took daily action to blockade the area, during a month of rolling resistance (Cuadrilla Resources, 2011; Hayhurst, 2018; Jaspal & Nerlich, 2014). Cuadrilla presently has licenses for eight sites in the UK and has drilled three wells, all in Lancashire (Harvey et al., 2013). Some of their conventional and unconventional sites are briefly discussed:

Preston-New-Road (Little Plumpton) site: Planning permission was refused by the Lancashire County Council (BBC Publication, 2015). However, this decision was appealed by Cuadrilla, and the government accepted their appeal in 2016. An appeal against this reversed decision has lost in the Court of Appeal in January 2018 (BBC News, 2018; Dehon, 2017). On July 24, 2018, the Energy Minister gave Cuadrilla a permit to begin fracking at Lancashire well. Claire Perry said that “Our world-class regulations will ensure that shale exploration will maintain robust environmental standards and meet the expectations of local communities” (Vaughan, 2018, p.45)in response to criticisms levied at the new license. Cuadrilla plans to apply for a second fracking license soon.

Cuadrilla drilled in 2011 (Cuadrilla Resource, n.db) and in September 2011 announced the discovery of 200 tcf of gas in place under the Fylde Coast in Lancashire (Macalister,

2011). Cuadrilla hoped to recover 10–20% of the gas and that it could provide 5,600 jobs in the UK at the peak of production (West, 2011). At the same time, Lord Browne claimed that the Lancashire discovery could satisfy the UK's gas consumption for 56 years (Macalister, 2011).

The 2012 media report indicated that the shale gas found was so rich that it could meet Britain's needs for decades (Leake, 2012). And that shale gas in Lancashire alone could deliver £6bn of gas a year for the next three decades, that it had the potential to do more for Lancashire than the cotton industry (Clover, 2011). The British Geological Survey, responsible for producing UK's mineral resource inventories, were cautious in their estimates, re-evaluated its projections in light of the find (Leake, 2012). As of February 2013, Cuadrilla had estimated that Lancashire's shale gas could have a market value of £136 billion.

Grange Hill, Singleton: This site is located near Singleton. Planning consent was granted in April 2010, and the well was drilled to a depth of 10,700ft in 2011. The well was not fractured hydraulically, and no flow testing of natural gas was undertaken. Cuadrilla decided not to apply for permission to carry out hydraulic fracturing at this site. In May 2014, Cuadrilla applied to Lancashire County Council for planning permission to install seismic monitoring and pressure monitoring sensors within the existing exploration well to carry out monitoring of existing and baseline conditions. The site is currently being decommissioned and returned to its original use as agricultural land.

Weeton, **Lancashire**: The Preese Hall site is located at Weeton. Lancashire County Council granted planning consent in October 2009 to drill a vertical exploration well into the shale rock, hydraulically fracture the shale, and test the flow rate of natural gas from the shale. The well at this site was drilled to a depth of 9,200 feet with work commencing in August 2010. During hydraulic fracturing in the spring of 2011, two induced seismicity

were experienced at the site. One of the earthquakes was large enough to be felt by some people at the surface and damaged properties (Harvey et al., 2013). Cuadrilla announced in December 2013 that the Preese Hall site was to be plunged with cement and the site restored to greenfield status. This was completed in April 2015 (Cuadrilla Resource, 2018).

Elswick: This site is currently Cuadrilla's only production well site, and the vertical well was hydraulically fractured in the underlying natural gas-bearing sandstone formation in 1993 (Cuadrilla Resource, 2018). The natural gas produced from this well has been used to continuously generate 1 megawatt of electricity during its early life. Gas extracted from the sandstone formation was sent to a small onsite generator and generated electricity fed into the electric grid through underground cables. The natural gas production rate has been declining over the production life, and the well has now approached the end of its producing life (Leake, 2012). Cuadrilla has frequently used this as a showpiece site.

2.2.7 Chapter Summary

This chapter examined the socio-economic condition of residents in the Preston-New-Road hydraulic fracturing site. The circumstances that led to the UK government's final approval of fracking were discussed, and opinions from interested stakeholders were also examined. Finally, I examined Cuadrilla Mining Resources' operations and activities in Lancashire and other areas. The next chapter explains the theoretical basis which underpins this thesis.

3.0 CHAPTER THREE: THEORETICAL PERSPECTIVE

3.1 Introduction

The third research question in this thesis seeks to identify the likely predictors of the variation in stress measured by the IES-R in the Preston-New-Road community. This chapter forms the theoretical basis for the justification of the three essential concepts that are likely thought to be theoretically related to stress. In particular, section 3.2 discusses community attachment as a predictor of fracking-related stress. Section 3.3 discusses social capital as an indicator of fracking-related stress, and section 3.4 discusses perception of recreancy as an indicator of fracking-related stress. 3.5 examines the relationship between community attachment, social capital, and the perception of recreancy and proposes a linkage between these concepts. These concepts are measured in the survey and used to predict stress (Research Question 3) in the analysis presented in chapter seven.

3.2 Conceptualisation of Community Attachment

There are different interpretations of community attachment throughout the literature. According to Kasarda & Janowitz (1974) and Wirth (1938), community attachment reflects the solidarity of social relations among residents in a community. “The local community is viewed as a complex system of friendship and kinship networks and formal and informal associational ties rooted in family life and ongoing socialization process” (Kasarda & Janowitz, 1974, p.329). Therefore, the weakening of social bonds will decrease the social importance of a community, subsequently leading to a lower level of community attachment among residents.

Other researchers also interpret community attachment as psychological. For instance, Sarason (1988) defined community attachment as “an acknowledged

interdependence with others, a willingness to maintain this interdependence by giving to or doing for others what one expects from them, the feeling that one is part of a larger, dependable and stable structure" (Sarason, 1988, p.327). O'Brien & Hassinger (1992) studied community attachment among local community leaders and discovered that community attachment has two psychological dimensions: the level of the sense of fit, and the evaluation of the local community.

For some researchers, community attachment is affective, and may be independent of individual evaluation of the community and the local social bonds within the community. For instance, Guest & Lee (1983) demonstrated that community evaluation and attachment are two somewhat different concepts. According to them, community attachment (sentiment) is based primarily on an individual's affectual attraction to the community. In contrast, community evaluation (satisfaction) is based on an individual's perception of the community as a nice place to live. Guest & Lee (1983) further theorized that residents who had a positive evaluation of the community might not be attached to the community, and residents attached to the community might not be satisfied with the community. A similar study by John et al. (1986) argued that individuals with few social ties in a community might still show a higher level of attachment to the community.

The multidimensional concept of community attachment has been used in studies to emphasize both the social and the psychological attachment of individuals to a community. Because of this, Stinner et al. (1990) defined community attachment as "the behavioural, structural, and perceptual linkages of individuals to their community of residence" (Stinner et al., 1990, p.495). They measured community attachment with three concepts: involvement, amity, and sentiment. According to their definition, involvement concerns the extent of one's participation in the local community; amity refers to the strength of individual local social bonds; and sentiment is individuals' subjective feelings toward each

other and their community. Goudy (2010), in his study of community attachment in rural Iowa, also defined community attachment through two-dimensional measures: local social bonds, and local sentiments. Individual attachment to a community has been conceptualized from different perspectives across research situations, concerning interpersonal relationships, and individual cognitive sentiments towards the community.

In other studies, community attachment can be thought of as the extent to which residents of a place possess cognitive or affective ties to each other and to that place (Shaker, 2017). Within environmental psychology, many defined interest in the concept of community attachment can be traced to the rise of urbanization and industrialization in the early part of the 19th century (Shaker, 2017). This theory of community attachment was developed due to the movement of large numbers of immigrants into urban areas.

These changing demographics had social impacts on development and how residents felt about their new communities and the left-behind communities. Community attachment remains an essential concept in the social sciences as researchers examine the influence of urbanization on community sentiment, the disruptive effects of rapid population growth, the implications of community attachment for social and mental well-being, and the significance of community attachments to conflicts over land use.

Cross (2003) defined community attachment as a positive affect bond between an individual and the place in which they reside. The main characteristics of which is the individual's desire to maintain closeness to that place. The community attachment literature tends to think of a person’s place of residence as either their neighbourhood or their town. However, people can be attached to different dimensions of place. Some are attached to the natural environment, others to the built environment (neighbourhood and town), and others to the social environment (family and friends). An essential aspect of community

attachment is a sense of community. Sense of community is vital to positive mental health. Smaller communities often provide a greater sense of connection to a community. However, other factors influence the ease with which people develop a sense of community. The next section will briefly discuss a sense of community as an essential component of community attachment.

3.2.1 Sense of Community as a catalyst for Community Attachment

The social and medical sciences offer a wide range of terms for that feeling of connection amongst people and the benefits or cost resulting from their behaviour. Whether it is called social capital, social support, neighbourhood connection, place attachment, community attachment, or a sense of community, is one of the basic human needs (Chavis et al., 1986; Chavis & Wandersman, 1990; Hyde & Chavis, 2007; McMillan & Chavis, 1986).

Sense of community fundamentally refers to an individual's community life experiences (Hyde & Chavis, 2007). Individual perception of a community influences his interaction with other community members. The quality and purpose of these interactions determine a community's vitality. There is some evidence that a sense of community is related to community involvement (Hyde & Chavis, 2007).

According to Hyde & Chavis (2007) over 65 years of research on the sense of community in the United States indicates that having a sense of community is strongly associated with lower levels of mental, social, and health disorders. Having a sense of community have also been shown as a protective factor and a significant contributor to an individual's resilience to health and other disorders (Hyde & Chavis, 2007; Kobasa, 1979). Building a sense of community can also encourage neighbourhood block associations' participation as a collective response to community stressors and involvement in community development (Bachrach & Zautra, 1985; Hyde & Chavis, 2007; Wandersman & Giamartino, 1980a).

Sense of community is the feelings of belonging, and attachment one has for the people and the place where s/he lives. The psychological sense of community is believed to be an essential ingredient in determining involvement in community activities. Individuals who perceive themselves as having no investment in the community are likely to view community problems as irrelevant to them and not become involved in community activities.

There is some evidence that a sense of community is related to community involvement (Carr et al., 1976; Wandersman & Giamartino, 1980). Wandersman & Giamartino (1980) found that residents who attend neighbourhood meeting possessed a greater sense of community and value a sense of community more than residents who do not attend meetings. Participation by neighbourhood residents has been proposed as an effective method for improving the physical environment, services, crime prevention, traffic, and neighbouring behaviour. Community participation is, therefore, an essential aspect of the sense of community and community attachment. The next section will consequently discuss citizen participation in community organization and the factors that influence individuals to participate in such activities.

3.2.2. Community Participation in Voluntary Community Activities.

Social scientists have identified several types of communities: community as a place, community as relationships, and community as collective political power (Gusfield, 1978; Heller, 1989; Suttles, 1972). There exists a process of improving the quality of community life. A central mechanism in this process is the individuals' participation in voluntary organizations which produce collective and individual goods. Citizen participation in community organization has been viewed as an effective method of improving the physical

environment's quality, enhancing services, preventing crime, and improving social conditions (Ahlbrandt & Cunningham, 1979; Altshuler, 1970; Morris & Hess, 1975).

Chavis & Wandersman (1990) postulate that three important components influence an individual's participation in voluntary neighbourhood organizations and that sense of community plays a catalytic role in mobilising the three components. These three components are (1) the perception of the community environment, (2) social relations, and (3) perceived control and empowerment within the community. These three concepts are examined below.

Perception of the Community Environment

Perception of the environment involves judgement about the environment, i.e., perceived qualities of the environment, satisfaction with the environment, and problems of the environment. Assessments are made about the degree to which the environment or a specific aspect of the environment is positive or negative to the individual. If it is viewed negatively, it can lead to stress and arousal (Bandura, 1982; Wandersman & Giamartino, 1980a).

A literature review has concluded that in general, there is a substantive relationship between the qualities of the physical environment, the social environment (social interaction and sense of belonging) and residential satisfaction (Echessa, 2013; Kwon et al., 2019; Rich, 1979). Negative signs in the environment such as litter, abandoned cars, or gangs on the street, can lead to fear of crime, lower property values and social withdrawals (Ahlbrandt & Cunningham, 1979; Hope, 1995; Lewis & Salem, 1981; Skogan & Maxfield, 1981). A sense of community and social cohesion have been found to moderate negative environmental factors such as crowding (Aiello & Baum, 1979; Freedman, 1975).

On the other hand, the perception of environmental problems can serve as a motivator to action. Most neighbourhood organizations are formed to respond to the threat or reality of physical deterioration (Crenson, 2013; Lavrakas et al., 1981). Florin & Wandersman (1984) found that the local organizations did help improve the community environment.

A sense of community is associated with the symbolic interaction that occurs through the physical environment. For instance, as people identify with their neighbourhood, they personalize their homes, contributing to the development of common symbols (Taylor, 1988a). Common symbols are part of the members' components of the sense of community described by McMillan & Chavis (1986), and these include languages, clothes, and neighbourhood name. This perception can lead to feelings of security, order, friendliness etc. As residents feel more safe and more secure in their community, they are likely to interact more with their neighbours, feel a greater sense of community, and have more incentive to participate.

Social Relations

Social interaction is the interaction among neighbours such as informal visit, borrowing and lending of tools, and asking for help in an emergency (Unger & Wandersman, 1985). Through this interaction, neighbours provide each other with emotional or personal support, instrumental, and informational support. When people feel a sense of community, they are more apt to interact with each other in their community (Chavis et al., 1986; Unger & Wandersman, 1985).

The social network in a neighbourhood develops, supports, and supplements the neighbourhood association's efforts by sharing information about the association, fostering the co-production of services such as sanitation and security, through informal social control (Rich, 1979).

In general, residents who socially interact with their neighbours are more likely to be aware of local voluntary organizations and become members (Wandersman & Giamartino, 1980a). This is particularly true for neighbours who have more friends in their community and close ties with their neighbours who they rely upon for socioemotional and instrumental support (Ahlbrandt & Cunningham, 1979; Hunter & Janowitz, 1982). The presence of a social network in a community helps regulate social behaviour through normative mechanisms called informal social control.

Perceived Control and Empowerment

Perceived control relates to the beliefs an individual has about the relationship between actions or behaviour and outcomes. Florin & Wandersman (1984) applied a cognitive, social learning approach to this phenomenon, whereby expectancies of individual and collective control were used to predict participation. Individuals evaluate the likelihood that their efforts, i.e.., self-efficacy or a group of people working together (collective efficacy) can solve a neighbourhood problem (Bandura, 1982).

This expectancy can influence behaviour (e.g., participation in a block organization). Locus of control, i.e., generalized expectancies about outcomes being relaxed to one's actions or luck, chance, or powerful others, have also been empirically related to participation (Abramowitz, 1974; Florin & Wandersman, 1984; Zimmerman & Rappaport, 1988; Zimmerman et al., 1992).

Empowerment is a process by which individuals gain mastery or control over their own lives and democratic participation in their community's life (Zimmerman & Rappaport, 1988). Zimmerman and Rappaport further suggested that participation may be an essential mechanism for developing psychological empowerment because participants can gain

experience organizing people, identifying resources, and developing strategies for achieving goals (Zimmerman & Rappaport, 1988).

A positive relationship between a sense of community and empowerment has been suggested (Chavis & Newbrough, 1986; Maton & Rappaport, 1984; Rappaport, 1987; Rappaport, 1977). Maton & Rappaport (1984) found that developing a sense of community was related to psychological empowerment. In addition, Bachrach & Zautra (1985) found that a sense of community was positively associated with problem-oriented coping, i.e., taking actions to solve the problem, when people are faced with an environmental issue.

3.2.3 Community Attachment as Coping Community Stressor to Fracking

Much research exists on how people cope during an incredibly stressful events such as severe injury (Hamburg et al., 1953; Imbus & Zawacki, 1977), death of a loved one (Glick et al., 1974; Vachon et al., 1977), surgery (Cohen & Lazarus, 1973), and academic testing (Mechanic, 1962). Much attention has also been paid to how members in a general population cope with stressors of everyday life, such as problems associated with parenting, finance, work, and marriage (Folkman & Lazarus, 1980; Ilfeld, 1980a; Ilfeld, 1980b; Pearlin & Schooler, 1978). These studies showed that people employ various coping strategies to handle everyday stressors and that their evaluation of a stressful situation strongly influences how they will respond.

While much work has been conducted on how people cope with individual stressors, little research has focused on how people cope with community stressors during a threat of community disruption such as fracking. Community stressors refer to problems that affect many people in a given area (Kasarda & Janowitz, 1974; Wandersman & Giamartino, 1980b). Typically, these problems cannot be readily resolved by the individual alone and

thus require collective action. These stressors may be acute or chronic and originate from either within or outside the community.

Examples of community stressors include noise pollution from a nearby airport, the decision to close a local school, and high crime rates in a part of town. As suggested in the previous chapter, hydraulic fracturing (due to perceived negative impacts) can also induce community stress. The community stressor of interest in this thesis is hydraulic fracturing in Lancashire by Cuadrilla Mining Resources. Many rural communities near the extraction site are opposed to it (BBC Publication, 2018; Szolucha, 2016b). This section seeks to understand the psychosocial process of adaption in the face of this community stressor.

Coping is regarded as a response to stress. It is defined as "efforts, both action-oriented and intrapsychic, to manage (i.e., master, tolerate, reduce, minimize) environmental and internal demands, and conflicts among them, which tax or exceed a person's resources" (Lazarus & Launier, 1978, p.121). Thus, Lazarus and Launier provided a useful framework to conceptualize residents' coping patterns.

According to Lazarus & Launier (1978), an individual first appraises a situation in terms of what is at stake for one's well-being. If the condition is perceived as a threat, the person will employ two general coping types to manage the stressor. 1) Problem-focused coping refers to efforts to address or alter the situation posing a threat directly. 2) Emotion-focused coping refers to efforts to regulate one's emotional response to the stressor. Other investigators have identified similar functions (George, 1974; Pearlin & Schooler, 1978).

Appraisal and Coping with a Community Threat

Lazarus (1966), and Lazarus & Launier (1978) have proposed appraisal as an essential determinant of the coping process to understand how community residents will respond to

a perceived threat. Folkman & Lazarus (1980) hypothesized that the appraisal of a situation influences the type of coping employed. Folkman & Lazarus (1980) studied middle-aged adult adaptation to everyday life. They found support for their hypothesis: Residents who believed that they could do something about a particularly stressful situation employed more problem-focused coping than residents who believed it was a situation that must be accepted. Emotion-focused coping was used more by residents who believed a situation needed to be accepted in contrast to community members who felt something could be done about the stressor.

Collins et al. (1983) reported that two years after the Three Mile Island (TMI) nuclear accident[11], residents in the area employed primarily emotion-focused coping strategies, presumably because little could be done to change what had occurred. Together, these studies suggest that if people feel they can impact a problem, they will be more likely to employ problem-focused coping. How people come to decide whether they can be useful in changing a stressful situation is not as straightforward as it may appear at first glance. People may examine how they had dealt with similar cases in the past, assess their strengths, determine their interest in the problem, and observe how others are reacting (Bachrach & Zautra, 1985). Bachrach & Zautra (1985) believed that self-efficacy, i.e., one's belief in one's ability to succeed in a specific situation is an essential coping strategy, and this will be discussed next.

Self-Efficacy as a Coping Strategy

Self-efficacy refers to an individual's appraisal of what they are capable of performing in a given situation. Bachrach & Zautra (1985), and DiClemente (1981) have demonstrated that

[11] The *Three Mile Island accident* was the partial *meltdown* of reactor number 2 of *Three Mile Island Nuclear* Generating Station (*TMI*-2) in Dauphin County, Pennsylvania, near Harrisburg and subsequent *radiation* leak that occurred on March 28, 1979.

perceptions of efficacy are accurate and often better predictors of future performance on tasks than past behaviour. Persons with a high sense of efficacy believe they can perform well, while those with a low sense of efficacy have little confidence in their ability to succeed. Such a cognitive mindset has obvious implications on how people appraise, and consequently cope with a threat.

Bandura (1982) makes an essential distinction between perceptions of efficacy and outcome expectations. He found that persons with a high sense of personal efficacy will utilize some action-oriented form of coping. He further found that a positive outcome expectation will lead to assured, opportune action. However, if the outcome is viewed negatively, social activism, protest, grievance and milieu[12] change will occur. This active interface with the environment contrasts with the passive nature of coping for persons with a low sense of efficacy. For such persons, feelings of incompetence are exacerbated regardless of the outcome expectation: A resistant environment results in apathy and resignation, while an accommodating one produces despondency and self-devaluation.

Bachrach & Zautra (1985) found that self-efficacy is in many ways related to the construct of hardiness. The essential personality dispositions of the hardy individual are commitment, control, and challenge. Individuals with such tendencies involve themselves in life in an active, rather than passive manner and believe they play an essential and influential role in dealing with life experiences. They welcome change rather than fear it, focusing on how they can grow from such change (Kobasa et al., 1982).

[12] a person's social environment

3.2.4 Measuring Community Attachment: Macro-Micro Linkage of Community Attachment

The relationship between the individual (micro) and the larger social context (macro) is a significant sociological inquiry issue. Durkheim (1957), in his study of suicide, formulated an essential sociological concept that individuals' behaviours are affected by the social context to which they belong. Etzioni (1990) in his work, the Moral Dimension, also stated that such a view of the "I – We" relationship as "a concept of persons of members of social collectivities. Collectivities that, to a significant extent, shape individual decisions" (Etzioni, 1990, p.14).

Following this conception, the micro-macro linkage of sociological inquiry has been explored in many substantive problems in sociology (DiPrete & Forristal, 1994; Huber & Schneider, 1991), and many researchers have used multilevel analysis methods to study "the interaction between variables that describe properties of individuals and variables that describe properties of social groups" (Hox & Kreft, 1994, p.283).

On community attachment, Sampson's (1988) study of an individual's community attachment among 11,000 residents in England and Wales is a first effort to examine individual and community factors' effects on individual community attachment. Based on the systemic approach of community attachment, Sampson examined the contextual effects of community residential stability, urbanization, density, victimization rates on individual-level friendship ties and attachment to the community. He found that community structures such as urbanization and victimization rates have significant contextual effects on individual attachment to the community: urban residents express less attachment to the community and residents in communities with higher victimization rates also show less attachment to the community. Thus, Sampson concluded that structural constraints affect individual behaviour and attitudes toward the community and that future research should

recognize that “community social integration is affected by both individual-level and broader, structural-level forces” (Sampson, 1988).

While the theory of community attachment previously reviewed suggests that those who are the most attached cope with various stressors more effectively, I do not believe this applies to events such as natural resource extraction that are viewed as threatening the very existence of the community itself (see Chapter 4 for more discussion). In particular, while those members that are the most attached to the community may tend to organize more frequently to cope with their stress, they will also still tend to be more impacted by events that threaten to harm their community. It is my belief that fracking is just such an event that would cause distress. As a result, those that are the most attached to the community are also the most likely to become distressed by the prospect of hydraulic fracturing. For this reason, *I hypothesize that as community attachment increases, stress related to hydraulic fracturing will also increase.*

This section discussed the concept of community attachment as an essential stressor to hydraulic fracturing. The next section discusses social capital as a stressor to hydraulic fracturing.

3.3 Conceptualization of Social Capital

Social capital is the level and kind of relationships or interactions between individuals and organisations (Narayan-Parker, 1999). Social capital is invested in human interactions in formal organizations and informal social groupings. Individual and group involvement in social interaction is influenced by factors such as; shared values and interest, geographical proximity, and history (Gauvin, 2011). According to Flora & Flora (2008, p. 7) “understanding the social interactions within a rural community, including any inequities, can help understand power differentials, social inclusion and exclusion, and processes by

which community action is initiated and developed". There are two types of social capitals; bonding social capital and bridging social capital (Gauvin, 2011; Jacobs, 2007). Bonding social capital is the type of interactions that takes place among homogenous individuals or group. This interaction occurs within the same community based on race, family, gender, and ethnicity (Flora & Flora, 2008). Members of this type of interaction are familiar with each other because they are in the same organisation or community.

Bridging social capital is the type of interaction between diverse individuals or groups to pursue a common course of action. "Such bonds tend to be emotional charged as individuals gather to pursue specific outcomes such as community betterment projects or to exclude specific development perceived as injurious to the community" (Flora & Flora, 2008, p. 8).

There are many definitions of social capital. However, there are still many questions about how to analyse social capital within communities. Most studies aggregate these in individual rather than community-level variables (Newton, 2001). Fey et al. (2006) found that the design of the measurement tool used to collect data on social capital is the primary tool that enhances effective and useful data on social capital.

Onyx & Bullen (2000) researched the effective ways to measure social capital in a community, and they concluded that "Social capital is a slippery but important concept; slippery because it has been poorly defined, important because it refers to the basic raw material of civil society" (Onyx & Bullen, 2000, p. 23-42). O'Brien et al. (2004) found the survey instrument Onyx & Bullen (2000, p. 1207-1217) used to be deserving of "further attention as a practical tool for…community agencies interested in social capital". They, therefore, modified Onyx and Bullen's Australian-based model for a US-based sample. They also found that the measurement of social capital has been difficult over time. They

stated that: “to date, several researchers have attempted to measure social capital with theoretically grounded instruments, although the trend appears to be the creation of new instruments rather than trying to replicate or refine an existing one” (O’Brien et al., 2004, p. 1208).

This notwithstanding, Inkeles (2000), proposed ways to measure social capital in a national level taking into considerations four broad categories and these are; culture patterns, social institutions, methods of association and communication between individuals and between collective entities, and psychosocial characteristics “of a given community or population” (Inkeles, 2000, p. 249). Larsen et al. (2004), conducted a study on how bonding and bridging social capitals, or social networks works toward successful civic action within a community. They found that “bonding social capital was a significant predictor of taking civic action. Therefore, people who associate with their neighbours and trust their neighbours are more likely to take action when controlling for all other variables” (Larsen et al., 2004, p 627).

By measuring the bonding and bridging social capitals in eight Arizona States of the US, they found that social networks make a difference in community action. Social networks are essential indicators of community coherence and development. The number of new groups formed and how communities seek outside help is an important tool for measuring social capital in a community (Fey et al., 2006).

This section examined social capital and its relevance. The next section discusses further the central theme of social capital and its origin.

3.3.1 Origin and Central Theme of Social Capital

Social capital, as a concept has received much attention from social scientists. The meaning and implication of the concept are, however, not well established. The term social

capital is believed to have come up during a discussion of rural school community centres by Lyda Judson Hanifan in 1916 (Hanifan, 1916). Hanifan was interested in the cultivation of characters such as sympathy, goodwill, fellowship, and general social intercourse among individuals in a community; she puts it as "those that make up a social unit" (Hanifan, 1916, p. 130). Hanifan generally described social capital as those tangible substances that count for most in the daily lives of people" (Hanifan, 1916, p.130). This concept has since received much attention from sociologist after 1916.

Notable among these sociologists is the contribution of Jane Jacobs in his work on urban life and neighbourliness (Jacobs, 1961); Pierre Bourdieu with regards to social theory (Bourdieu, 1983); and James Coleman's discussion on the social context of education (Coleman, 1988a), moved the idea into academic debates. Robert Putman's work advanced social capital and brought it to the limelight as a popular theme for research and policy analysis (Putnam, 1995). The World Bank has adopted social capital as a useful tool in organising idea. According to the World Bank, "increasing evidence shows that social cohesion is critical for societies to prosper economically and for development to be sustainable" (The World Bank, Grootaert, & van Bastelaer, 2011, p. 1-45).

The central theme in social capital discourse is that relationships matters and a social network is an essential and valuable asset that enhances community interaction and cohesion and enables the individual to build vibrant communities and commit themselves to the community (Field, 2008). According to Field (2008), a feeling of belonging correlated with trust and tolerance that comes with social network brings significant benefits to people. Christopher Been support this statement:

> Trust between individuals thus becomes trust between strangers and trust of a broad fabric of social institutions; ultimately, it becomes a shared set of values, virtues, and expectations within society as a whole. Without this interaction, on the other hand, trust decays; at a certain point, this decay

> begins to manifest itself in serious social problems… The concept of social capital contends that building or rebuilding community and trust requires face-to-face encounters (Beem, 2000, p. 20).

Further research has found that communities with strong and enough social capital have lower crime rates, better health, better economic growth, and higher education levels (Halpern, 2005). The downside to strong social capital in a community is groups' ability to exclude others who may be deemed less important. Although social capital has proven to be relevant, there are some critics of its application. The next section is devoted to some critical issues raised by researchers on social capital and its application in ensuring a sustainable society.

3.3.2 Negatives of Social Capital

The research literature on social capital strongly emphasizes its positive consequences. It is our sociological bias to see good things emerging out of sociability; bad things are more commonly associated with the behaviour of homo-economicus[13]. However, the same mechanisms appropriable by individuals and groups as social capital can have other, less desirable consequences. It is important to emphasize them for two reasons: first, to avoid the trap of presenting community networks, social control, and collective sanctions as unmixed blessings; second, to keep the analysis within the bounds of serious sociological analysis rather than moralizing statements.

Recent studies have identified at least four negative consequences of social capital: exclusion of outsiders, excess claims on group members, restrictions on individual freedoms, and downward levelling norms. First, the same strong ties that bring benefits to

[13] Homo economicus, or economic human, is the figurative human being characterized by the infinite ability to make rational decisions

members of a group commonly enable it to bar others from access. Waldinger (1995) describes the tight control exercised by white ethnics, descendants of Italian, Irish, and Polish immigrants, over the construction trades and the fire and police unions of New York. Other cases include the growing control of Korean immigrants' produce business in several East Coast cities, the traditional monopoly of Jewish merchants over the New York diamond trade, and Cubans' dominance over numerous sectors of the Miami economy. In each instance, social capital generated by bounded solidarity and trust is at the core of the group's economic advance. But, as Waldinger (1995, p. 557) points out, “the same social relations that…enhance the ease and efficiency of economic exchanges among community members implicitly restrict outsiders.”

Ethnic groups are not the only ones that use social capital for economic advantage. Two centuries ago, Smith (1979, p.232) complained that merchants' meetings inevitably ended up as a conspiracy against the public. Of course, the public is all those excluded from the networks and mutual knowledge linking the colluding groups. Substitute for “merchants” white building contractors, ethnic union bosses, or immigrant entrepreneurs, and the contemporary relevance of Smith's point becomes evident.

The second negative effect of social capital is the obverse of the first because group or community closure may, under certain circumstances, prevent the success of business initiatives by their members. In his study of Bali's commercial enterprises' rise, Geertz observed how successful entrepreneurs were assaulted continuously by job and loan-seeking kin. These claims were buttressed by strong norms enjoining mutual assistance within the extended family and among community members in general (Geertz, 1963). The result was to turn promising enterprises into welfare hotels, checking their economic expansion. Granovetter (1995) who calls attention to this example, notes that it is an

instance of the problem that classic economic development theory identified among traditional enterprises.

Weber et al. (1947) made the same point when he stressed the importance of impersonal economic transactions guided by universalism[14] as one of the significant reasons for Puritan entrepreneurial success. Thus, cosy intergroup relations of the kind found in highly solidary communities can give rise to a massive free-riding problem. Less diligent members enforce on the more successful all sorts of demands backed by a shared normative structure. For claimants, their social capital consists precisely of privileged access to the resources of fellow members. In the process, opportunities for entrepreneurial accumulation and success are dissipated.

Third, community or group participation necessarily creates demands for conformity. In a small town or village, all neighbours know each other. One can get supplies on credit at the corner store, and children play freely in the streets under other adults' watchful eyes. The level of social control in such settings is strong and quite restrictive of personal freedoms, which is why the young and the more independent-minded have always left. Boissevain (1974) reports such a situation in his study of village life on Malta's island. Dense, 'multiplex' networks tying inhabitants, created the ground for intense community life and vigorous enforcement of local norms. The privacy and autonomy of individuals were reduced accordingly.

This is an expression of the age-old dilemma between community solidarity and individual freedom analysed by Simmel (1995) in his classic essay on 'The Metropolis and Mental Life.' In that essay, Simmel came out in favour of personal autonomy and responsibility.

[14] loyalty to and concern for others without regard to national or other allegiances

At present, the pendulum has swung back, and several authors are calling for stronger community networks and norm observance to re-establish social control. This may be desirable in many instances, but the downside of this social capital function must also be kept in mind.

Constraints on individual freedom may be responsible for Rumbaut's findings that high levels of familistic solidarity among recent immigrant students are negatively related to four different educational outcomes, including grades and standardized test scores. According to this author, “family ties bind, but sometimes these bonds constrain rather than facilitate particular outcomes” (Rumbaut, 1997, p.39).

Fourth, there are situations in which group solidarity is cemented by a shared experience of adversity and opposition to mainstream society. In these instances, individual success stories undermine group cohesion because the latter is precisely grounded on such occurrences' alleged impossibility. The result is downward levelling norms that operate to keep members of an oppressed group in place and force the more ambitious to escape from it. In his ethnographic research among Puerto Rican crack dealers in the Bronx, Bourgois (1991, 2003) calls attention to the local version of this process, which singles out for attack individuals seeking to join the middle-class mainstream. He reports the views of one of his informants:

> When you see someone go downtown and get a good job, if they be Puerto Rican, you see them fix up their hair and put some contact lenses in their eyes. Then they fit in and they do it! I have seen it!…Look at all the people in that building, they all “turn-overs.” They people who want to be white. Man, if you call them in Spanish it wind up a problem. I mean like take the name Pedro—I'm just telling you this as an example—Pedro be saying (imitating a whitened accent) “My name is Peter.” Where do you get Peter from Pedro? (Bourgois, 1991, p.32).

Similar examples are reported by Stepick (1992) in his study of Haitian-American youth in Miami and by Trueba et al. (2014), and Matute-Bianchi (1986) among Mexican-American

teenagers in Southern California. In each instance, the emergence of downward levelling norms has been preceded by lengthy periods, often lasting generations, in which the mobility of a particular group has been blocked by outside discrimination. That historical experience underlines the emergence of an oppositional stance toward the mainstream and solidarity grounded in a common experience of subordination. Once in place, however, this normative outlook has the effect of helping perpetuate the very situation that it decries.

In the form of social control, social capital is still present in these situations, but its effects are precisely the opposite of those commonly celebrated in the literature. Whereas bounded solidarity and trust provide the sources for socioeconomic ascent and entrepreneurial development among some groups, among others they have precisely the opposite effect. Sociability cuts both ways. While it can be the source of public goods, such as those celebrated by Coleman, Loury, and others, it can also lead to public 'bad'. Mafia families, prostitution and gambling rings, and youth gangs offer many examples of how embeddedness in social structures can be turned to less than socially desirable ends. The point is particularly important as we turn to the more recent and more celebratory versions of social capital.

Lastly, although bonding and bridging social capitals can assist in overcoming multi-scalar impediments or barriers such as institutional 'structural holes' a 'silos' in communities (Dale & Newman, 2010), however, different communities may build social capital differently due to cultural differences and other social norms, such as a class in each community. This may provide the different relational context of power and politics.

Briggs (2004) further warns that differences in social norms of politics and power in various societies could prove problematic within a community when building social capital. An example of such norms includes: "expectations and norms of reciprocal

relationship, formation and use of social ties in a community, symbolism that may not or may be appropriate for instance religious, individual communication skills and social boundaries of bounding communities by a distinct ethnic grouping" (Briggs, 2004, p. 154).

There is a need to be aware of the dangers of 'capitalization'. Not everything of value should be called capital. There is a severe danger of skewing our consideration of social phenomenon and goods towards the economy. The idea of capital brings with it sets of discourses, which inevitably links it with capitalism (Cohen & Prusak, 2001).

3.3.3 Social Capital, Health, and Psychological Distress

Social capital refers to the idea that social networks are potential resources for individuals, communities, and society as a whole and are often used to refer to social relationships characterized by trust and reciprocity (Morrens, 2008; Putnam, 2001). Social capital has been related to different aspects of individual and population health, such as self-rated health, mental health and health care access (De Silva et al., 2005; Derose & Varda, 2009; Mansyur et al., 2008). Although many authors have reported the beneficial influence of social capital, social capital might also negatively impact health and well-being (Macinko & Starfield, 2001; Spencer Moore et al., 2009; Portes, 1998). Strong social bonds within a group might prevent others from joining the network, leading to 'outsiders' exclusion. Furthermore, high social capital levels can place large claims on group members due to restricting social control and pressure to conform to the group's prevailing social norms (Portes, 1998).

Social capital is introduced to the literature by scholars from different scientific disciplines, who each approach the concept from a diverse theoretical background (Macinko & Starfield, 2001; Szreter & Woolcock, 2004). Therefore, competing views on the concept can be distinguished in the current literature. Most empirical studies on social capital and

health have heavily focused on social norms within networks, such as trust and reciprocity, as the core of social capital (Kawachi et al., 2008; Moore et al., 2006). However, this focus has been subject to critique since it easily ignores the potential downside of social capital for health and the influence of social stratification on the access to and use of social capital (Carpiano, 2007; Song, 2009).

Consequently, some researchers have proposed a shift in social capital theory from a 'normative' to a 'resource-based' perspective (Carpiano, 2006; Lin, 2002; Rostila, 2011). The latter identifies the resources embedded in social networks as the core of the concept (Lin, 2002), and has some significant benefits over the 'normative' approach. Due to its strict focus on social networks resources, this version enables a clear distinction of social capital from its antecedents and consequences and facilitates the elaboration of testable hypotheses on social capital and health (Carpiano, 2006; Song, 2009). The resource-based approach to social capital is instrumental in studying social capital's role for health inequity since it incorporates the influence of social position on the access to and use of social capital (Carpiano, 2007; Lin, 2002).

Gender Differences in Social Capital

Social capital and, on a related note, social networks are not evenly distributed between both sexes; men and women's social networks differ in terms of composition, quantity, and type. These social capital differences are believed to arise from gender-specific socialization processes, differential societal expectations concerning social networking (van Emmerik, 2006) and men and women's varying opportunities to invest in social capital (Leeves & Herbert, 2014). Regarding networks' composition, men generally have fewer relatives in their networks than women (Ferlander & Mäkinen, 2009; Moore, 1990). Furthermore, men are frequently involved in formal networks (Ferlander & Mäkinen,

2009), while women are traditionally less involved in relationships that transcend power or authority gradients in society (also referred to as 'linking social capital' by Szreter & Woolcock (2004). About the quantity and quality of networks, men generally have more extensive social networks than women and are more trusting toward others (Norris & Inglehart, 2006).

Women have been found to more frequently participate in community networks (Chuang & Chuang, 2008; Kavanagh et al., 2006). Furthermore, women tend to join in associations with a caring or domestic focus or groups associated with education, arts and religion. In contrast, men mostly participate in associations focused on the economy, business, politics or sports (Norris & Inglehart, 2006).

Gender differences in Mental Health

Men and women not only differ in their social networks but also in their health status. More specifically concerning mental health, the prevalence of most mood disorders and anxiety disorders is higher in women, while most externalizing disorders and substance use disorders often found in men (Kuehner, 2003; Seedat et al., 2009; Stoppard, 1999). Concerning depression, social epidemiologists have consistently reported gender differences, with women reporting more severe and more frequent depressive symptoms (Seedat et al., 2009; Stoppard, 1999; Van de Velde et al., 2010).

For example, the 2008 Belgian Health Interview Survey data shows that 13% of the Belgian women older than 15years reported depressive complaints. In contrast, these complaints are reported by only 6% of their male counterparts (Van de Velde et al., 2010). These differences can partially be artificial due to differences in reporting depressive symptoms and seeking help. However, the literature stresses that mental health differences

between men and women persist after taking these factors into account.

The gender gap in mental health can be attributed to different biological, psychological and social factors (Denton et al., 2004; Kuehner, 2003; Matud et al., 2003; Piccinelli & Wilkinson, 2000; Stoppard, 1999). Concerning biological explanations, it is hypothesized that women are prone to develop depression due to biochemical mechanisms such as hormonal and neurotransmitter systems, and specific factors related to the reproductive biology of the female body such as menstrual cycle, pregnancy, childbirth and menopause (Halbreich & Lumley, 1993; Kuehner, 2003; Stoppard, 1999).

Furthermore, different psycho-social pathways contribute to gender differences in depression. For instance, personality attributes that predispose to depression, such as dependency and self-criticism, are often considered aspects of female gender identity. Also, the specific social roles women are likely to take up during their lives such as caring and domestic roles, combining work and private life, and the social position of women in society are believed to contribute to the differences in depression rates between men and women (Kuehner, 2003; Stoppard, 1999).

Can Social Capital Contribute to the Explanation of Gender Differences in Mental Health

The differential mobilisation of social capital might be one of the psycho-social pathways that underlie the gender gap in mental health problems. However, the social capital theory has generally been critiqued to be "gender blind" (O'Neill et al., 2013). This is because the question of whether social capital's association with health differs between men and women has received hardly any attention from the founding fathers of social capital theory (Ferlander & Mäkinen, 2009). This question is also rarely addressed in empirical research.

Empirical articles that address whether social capital differently influences men and women's health are limited and research findings are mixed.

Moreover, the few studies that address this research question mostly focus on social capital at the local neighbourhoods level, to the detriment of research on individual social capital. When gender is found to moderate the association between neighbourhood social capital and health, the positive association of social capital with health is generally stronger for women than men (Chuang & Chuang, 2008; Kavanagh et al., 2006; Stafford et al., 2005). This could be explained by women's higher exposure to neighbourhood processes (Chuang & Chuang, 2008; Kavanagh et al., 2006; Stafford et al., 2008).

Although social capital has some critics, it is an essential tool that can enhance sustainable community development. The next section will examine social capital as a relevant tool in sustainable community development.

3.3.4 Social Capital and Sustainable Hydraulic Fracturing Community Development

Analyses of available literature have pointed to the transition towards a more sustainable community development being virtually dependent on social networks and group participation. Further literature on sustainable community development emphasises the importance of bottom-up community participation (Bajayo, 2012; Cuthill, 2010). Also, communities with high social trust and civic involvement have social capital, and this is an essential resource that may benefit people in the community, including those who may not participate actively and those who may not trust much (Putnam, 2000).Communities with high social capital are better organised to solve common or shared problems including managing fragile and shared natural resources, and providing social support locally that government and other state institutions are not equipped or unwilling to provide (Bowles &

Gintis, 2002; Brown & Keast, 2003). It is vital for urban policies[15] on sustainable community development on hydraulic fracturing to "seek to bring people together, to weave the various parts of the community into a cohesive whole, and to increase accessibility (spatial and otherwise) to public services and employment, with the framework of a local governance structure which is democratic, efficient, and equitable" (Polese & Stren, 2000, p. 43).

According to Osborne et al. (2016), a socially resilient community's characteristics include social cohesion, civil trust, and collective efficacy. These are expressions of community strength and contribute essentially to a well-functioning democracy. Communities with high and robust social capitals are also more resilient to weather-related events such as climate change (LaLone, 2012; Smith et al., 2012). They provide opportunities for more innovation, economy and growth (Yigitcanlar et al., 2012), and help buffer harmful influences of neighbourhood deprivation (Poortinga, 2012).

To enhance social capital in hydraulic fracturing communities, it is essential for local governance authorises to make a considerable effort in fostering social capital. This can be done through community engagements, political engagements, planning for cultural diversity, urban design, enhancing access and mobility, and housing. These are all indicators used to identify and measure community strength (Department of State Development, 2006). As an essential public discursive good, social capital has a significant potential for planning that enhances sustainable community development.

Strong social capital increases the level of attachment and affiliation to the community; hence any activity or project that seeks to disrupt life in the community is a cause of

[15] Urban policy is an urban cohesion and solidarity, national and local policy, towards disadvantaged urban areas and their inhabitants

concern. This will increase psychosocial stress in the community. From the above discussion of social capital, I hypothesize that *increasing social capital in a community will increase stress associated with hydraulic fracturing.* The next section will discuss the perception of ‘recreancy’ as an essential variable that predicts stress in a community.

3.4 The Concept of Perception of Recreancy

The late twentieth century has brought a ‘risk society’ not just through the potential wartime use of weapons but also through ‘peaceable’ activities, such as producing, testing, and managing nuclear technologies and their wastes. The problem is by no means limited to atomic risks.

Instead, we are experiencing the emergence of what Kai Erikson has termed ‘a new species of trouble’ with a widening range of non-nuclear technologies, involving hazardous chemicals, facilities, transportation technologies, and many of the other controversial components of contemporary technologies (Erikson, 1994) such as hydraulic fracturing. These pervasive yet 'everyday' risks highlight a severe flaw of Durkheim's conception of the division of labour in society, in part because of a widespread failure to recognize the present-day implications of Weber's insights into what it means to say that we live in a 'rationalized,' technological world. In statistical terms, the risks of death have been dropping significantly for more than a century. During that same time, however, there has been a dramatic growth of societal interdependence. Hence, the potential for recreancy –

institutional actors' failure to carry out their responsibilities with the degree of vigour necessary to merit the societal trust they enjoy. Furthermore, as the process has advanced, there has been a substantial decline in the broader society's ability to assure that its specialists do indeed serve the interests of the larger collectivity and that its 'responsible officials' act responsibly (Freudenburg, 2000, p108).

Accordingly, Freudenburg theorized the concept of perception of 'recreancy' to encompass the "behaviours of persons and/or of institutions that hold positions of trust, agency, responsibility, or fiduciary or other forms of broadly expected obligations to the collectivity, but that behave in a manner that fails to fulfil the obligations or merit the trust" (Freudenburg, 1993, p916-917). Moreover, Freudenburg, stressed the perceived failure of "specialized organizations to execute responsibilities properly to the broader collectivity with which they have been implicitly or explicitly entrusted (Freudenburg, 2000, p116).

Sapp et al. (2009) building from Freudenburg works, in conjunctions with other theoretical approaches to understanding trust, adapted the perception of recreancy theorem to focus on how "the public's trust is explained by their receptions of the competence of institutional actors and their belief that these actors will behave with fiduciary responsibility" (Sapp et al., 2009, p520). Accordingly, institutional actors must simultaneously be viewed as competent and responsive to the needs of the public at large. Therefore, the perception of recreancy theorem "recognizes that people evaluate risk based upon their assessments of institutional responsibility as well as upon quantitative assessments issues by technical experts" (Sapp et al., 2009, p.530). In this view, perception of recreancy focuses on whether people believe that institutional actors responsible for risk management can be counted on to carry out their charge competently.

3.4.1 Technological Disasters, Perception of Recreancy, and Hydraulic Fracturing.

Perception of recreancy serves to highlight the fact that technological disasters most often are not the fault of individual people, but rather stem from errors at institutional and systemic levels, both in primary responsibility and oversight (Clarke, 1990, 1993; Erikson, 1994; Freudenburg, 1993, 2000; Perrow, 1999; Ritchie et al., 2013). The concept of

perception of recreancy especially fits for use in studies of technological or human-caused disasters where blame and identification of "responsible parties" have become institutionalized. It offers essential insights into social impacts such as loss of social capital and civility and psychological responses of frustration, anger, and hostility frequently associated with these types of events (Kroll-Smith, 1995; Ritchie, 2004; Ritchie & Gill, 2007).

Perceptions of recreancy associated with technological disasters elicit emotional reactions such as fear, frustrations, loss of trust, increased levels of uncertainty, and anger (Ritchie, 2004). According to Richie, these emotional responses translate into beliefs about the reliability of institutions and organizations. They transform our "landscape" (Edelstein, 1989), alter how we see the world, and disrupt ontological security, i.e., confidence in one's self-identity, and in the stability of one's social and physical surroundings (Giddens, 1991; Kroll-Smith, 1995). Eventually, these beliefs become factors in risk assessment. They are not just shallow perceptions subject to change. Instead, these risk beliefs are based on experience and deeply held convictions influencing the day-to-day decision-making process.

Generalized trust in 'formal' social capitals or organizations tends to decline in these post-disaster contexts. These dynamics elicit a social response that drawdown reserves of social capital, setting the stage for the emergence of individual and collective trauma, lifestyle, and landscape changes, and secondary trauma (Gill, 2007; Ritchie, 2004, 2012; Ritchie et al., 2013; Ritchie & Gill, 2007).

Assessing perceptions of recreancy affords important insights following a technological disaster when there often is an identifiable 'primary responsible party' (PRP) that acts as a focal point for blame, hostility, frustration, and, ultimately, compensation (Gill et al., 2012;

Marshall et al., 2003; Ritchie, 2012; Ritchie et al., 2013). The perceived levels of perception of recreancy associated with the PRP remain high throughout the disaster process (Gill, 2007; Ritchie, 2004). However, as the disaster unfolds over time other institutional actors such as the government are often drawn into the web of culpability as well (Couch & Kroll-Smith, 1994; Gill et al., 2012; Walsh, 1981).

Perceptions of recreancy may increase for the PRP, and other actors throughout a disaster as victims recognize mismanagement, institutional practices, and organizational decision-making to contribute to disaster-related disruptions. Conversely, there are also opportunities for the perception of recreancy to decrease over time if institutional actors are perceived to rectify past failures and act in good faith to mitigate ongoing risk, compensate victims, and contribute to community recovery efforts.

3.4.2 Application of Perception of Recreancy

Perception of recreancy has been used as a theoretical guide by researchers investigating a range of issues explaining public opposition to nuclear repository siting in the United States (Freudenburg, 1993; Richards & Brod, 2004), understanding the aftermath of Hurricane Katrina (Freudenberg et al., 2010; Freudenburg et al., 2008). Perception of recreancy has also been used in other related issues. For instance, Bickerstaff et al. (2008) used the term to explain how citizens in England construct responsibility for technological risks. Scott et al. (2005) used the term to understand blame and mistrust after a breach of coal waste impoundment in eastern Kentucky. Marshall et al. (2003) also examined the perception of recreancy in the context of the 9/11 terrorist attacks, and the perceived failures of government intelligence agencies, airport security, and other institutions to protect the public. Ritchie (2004) discussed the consequences of perception of recreancy

concerning the Exxon Valdez spill[16] and the ensuing litigation. Also, Sapp et al. (2009), and Sapp & Downing-Matibag (2009) used the perception of recreancy to examine consumer trust in the United States food system.

Perception of recreancy especially fits for use in technological disaster studies such as hydraulic fracturing, where issues of blame and identification of responsible parties have been institutionalized. It also offers important insight into social impacts such as loss of social capital and psychological responses of anger, frustration, and hostility frequently associated with these types of events (Kroll-Smith, 1995; Ritchie, 2004; Ritchie & Gill, 2007; Tierney, 1978).

3.4.3 Institutional Relationship, Interpersonal Trust and Recreancy

In his 1984 presidential address to the American Sociological Association, James Short noted the critical importance of exploring the larger institutional context where risks are organized and managed. The institutional context is composed of relationships among, for example, residents, governments, corporations, religious groups, and non-profit organizations. These relationships interact with perceptions of vulnerabilities and experiences to attenuate or amplify perceptions of risk and capacities to act (Eargle & Esmail, 2012; Kasperson et al., 1988). Trust is integral to understanding institutional relationships and risk.

The concept has been described in various ways, including as a personality trait, embedded in interpersonal relationships, and a kind of social organization (for a review, see Shapiro, 1987)). As Freudenburg (1993b, p.916) suggested, trust was exercised or withheld by

[16] On March 24, 1989, the tanker Exxon Valdez ran aground on a well-marked reef in Prince William Sound (PWS), Alaska, leaking between 11 and 33 million gallons of crude oil.

principals in an assessment of an agents' performance or "getting the job done." This notion of interpersonal trust serves as a foundation for organic solidarity or the ties that bind people to one another in society (Durkheim, 1964). Public trust in natural resource organizations – such as British Petroleum and the Department of Interior– is crucial because resource managers mediate risks within and adjacent to the community. Residents who have less confidence in the institution's ability to fulfil its role are more likely to have increased risk perceptions (Perrings, 1998).

These residents are not as likely as those with positive feelings to trust institutional risk assessment and reduction policies (Freudenburg, 1993b). Also, community concern and implementation of risk reduction policies are less likely when agency roles are not clearly defined and communicated. Communities in which residents understand institutional responsibilities across different spheres of public and private life, including the media, non-profit groups, schools, churches, and governments are more likely to display higher interactions and participation (Summers, 1986). Clear, concise, and repeated information is essential for effective risk communication (Kumagai et al., 2004; Waugh & Streib, 2006). In contrast to technological perspectives of risk (e.g., see Starr, 1969), this information is not only based on communicating statistical probabilities; it includes other forms of expressing environmental risk through symbols present in residents' daily lives. Perception of recreancy reflects assessments of institutional actors' competence to carry out a fiduciary responsibility with citizens. In short, citizens must perceive that institutions can and do carry out their societal roles, failing to fulfil the merit of trust (Freudenburg, 1993b). Recreancy stems from the interdependencies of increasingly complex social systems. Alario and Freudenburg stated that:

> As a result of the division of labour, citizens of advanced societies are dependent not only on the technologies, but also on the social relations that bring them into being, involving whole armies of

> specialists, most of whom have areas of expertise that we may not be competent to judge, and many of whom we will never even meet, let alone have the ability to control (Alario & Freudenburg, 2003, p.200).

Perception of recreancy is more specific than trust. Trust is an emotionally laden term that involves a projection of values ascribed to appropriate individual behaviours. In the case of recreancy, there is not necessarily an individual wrongdoer. Instead, institutional failure occurs because the complexity of the social structure involving countless specialized individuals and institutions increases the risk of a technical competency breakdown and fiduciary responsibility. Neither is recreancy synonymous with risk perceptions. Recreancy is a critical component of risk perceptions. However, risk perceptions emphasize residents' evaluations of the hazard itself, rather than focusing strictly on the societal institutions associated with the hazard. Institutional failure results from insufficient abilities or actions that contradict the perceiver's values (i.e., technical competence and fiduciary responsibility). In effect, labour division can increase vulnerability when obligations are not carried out properly, and the wrongdoer cannot be identified.

Few studies have tested the notion of perception of recreancy with empirical observations. One exception is Freudenburg (1993b) analysis of concern over nuclear waste handling in which perception of recreancy explained three times as much variance in levels of concern as sociodemographic and ideological variables. McSpirit et al. (2005) investigated relationships between the coal industry, regulatory agencies, and residents following a major disaster in Appalachia.

The authors suggested the EPA utilized a regulatory framework that pre-empted the agency's authority to recover costs associated with health and environmental damages due to mining activities. Perception of recreancy was further pronounced because the

bureaucratic process restricted community input into recovery. In another study, Freudenburg & Gramling (1994) found that residents confused the U.S. Mineral Management Service (charged with regulating offshore drilling) and industry because the agency had used impact statements to justify drilling. After years of disaster-free operation, this study concluded that petroleum production did not seem as disruptive to the environment as initially anticipated, thereby leading to an "atrophy of vigilance" among regulatory agencies and citizens alike (Freudenburg & Gramling, 1994, p.176).

In keeping with these studies, I explore the link between community response to hydraulic fracturing in Lancashire and perceptions of recreancy. I hypothesis *that as the perception of recreancy increases, reported levels of hydraulic fracturing stress would also increase.*

3.5 Social Capital, Community Attachment and Recreancy

This chapter's previous sections have sought to link social capital, community attachment, and perception of recreancy to psychosocial stress. It is generally proposed that an increase in community participation directly corresponds to an increase in social capital, community attachment, and perception of recreancy of residents, and this will likely increase psychosocial stress when faced with community threat such as hydraulic fracturing. This section discusses that social capital, community attachment, and perception of recreancy are related to participation. When people identify with a community and feel part of it they are more inclined to participate (Brodsky et al., 1999; Galster, 2003; Minkler et al., 2003). Through combining these three separate lines of thought, our understanding of the causes of participation can be enhanced, and hence their effects on causing psychosocial stress.

Social Capital

When discussing reasons for participation, social capital is often mentioned as helpful in giving people the tools and the will to act. Social capital theory starts from the principle of rational theory, in which individuals maximise their benefits within a particular social network (Coleman, 1988b; Portes, 1998; Putnam, 2001).

Although existing research has undoubtedly provided insight into why some people participate while others do not, empirical evidence of the combined impact of the three elements of social capital on participation is lacking. Often only one or two of the dimensions are considered, while social capital is a construct of the related concepts of social networks, trust, and the rejection of deviant behaviour.

Social networks reflect the degree of social interaction within communities (and families). When social networks are related to participation, they are often found to help facilitate involvement by bundling individual needs and capacities; in other words, networks allow collaborative action to take place (Kearns & Forrest, 2016).

People who are socially involved with each other are more integrated into their community and feel more positive about it, stimulating them to take a more active role in social and political affairs. Strong, dense, neighbourhood-based networks are assumed to provide support (Granovetter, 1995), while weak ties within a neighbourhood can provide the feeling of home, a sense of security and identity (Henning & Lieberg, 1996), and give people a sense of social order and social control.

Empirical research has revealed that active involvement in society is positively related to social networks in certain situations. In Wisconsin (USA), Kang & Kwak (2016) found that interpersonal networks constitute the most important explanatory variable for civic participation when residential variables, socio-economic status and demographic variables

are controlled for. Marschall (2016) also found that, in New York, in inner-city neighbourhoods, the local school's involvement increases with the number of social ties. Thus, those with social networks in the community may be expected to participate more.

Community Attachment

Community attachment can lead to a feeling of security, build self-esteem and self-image, give a bond to people, cultures and experience, and maintain group identity (Crow, 1994; Low & Altman, 1992; Taylor, 1988b). The idea is that people have ties with others and feel attracted to and identify with their immediate living environment (Blokland - Potters, 2000). Participation is encouraged when people think that they are attached to a neighbourhood and identify with it: what belongs to them needs to be protected, taken care of, and influenced.

The positive effect of community attachment on participation has been shown in earlier research. Individuals who identify with their neighbours and the community become empowered and willing to change their social and political environment to improve the quality of the lives they live there (Minkler et al., 2003). People who identify with the people around them score higher on various forms of participation, such as attending religious services, being registered to vote, and involvement in a neighbourhood organisation (Brodsky et al., 1999). This social type of neighbourhood attachment is positively related to participation. Community attachment is different from social networks since a person can have a strong community attachment feeling without having any real social contacts in the neighbourhood.

Another positive effect of community attachment on participation involves spatial-emotional neighbourhood attachment. This concept refers to the connection people feel with their home area and their sense of belonging to that place (Kearns & Forrest, 2016). A

general feeling of pride in the community makes people feel part of it (Massey, 2016). One of the causes of distressed urban areas' problems is a lack of community pride in the USA. An increase in such pride makes people change their behaviour in the community (Kaplan, 1934). Their positive attachment (both social and spatial-emotional) to the community will encourage people to act towards improving the situation there.

Perception of Recreancy

The perception of Recreancy is an essential factor that has been found to have a positive relationship with residents' participation in projects and activities that enhance community development and cohesion. The accumulation of the capability to act is an outcome of networks based on trust and commonalities and can be used in participation (Gittell et al., 2016). Two types of trust can be discerned: personal trust in co-residents, and authorities. First, people who trust each other will do so based on shared norms and group identification. For example, Marschall (2016) found in inner-city New York that community involvement is positively related to these feelings of trust. A lack of trust between individuals or groups in communities and partnerships can lead to difficulties in generating collective action (Purdue, 2016).

Second, the resident's participation in community projects is positively related to trust in authorities. Some authors noted the negative impact of the lack of trust in authorities in an area with a concentration of low-income households and ethnic minorities. Shirlow & Murtagh (2016) reported significant differences in how people feel about community authorities in a community in North Belfast. Despite a standard set of norms about how to behave, the authors found that feelings of mistrust and a negative attitude towards the neighbourhood authorities work against participation in voluntary associations.

Similarly, Ross et al. (2001) and Subramanian et al. (2003) found that trust level is lower in distressed than in average communities. The findings show that specific local circumstances can lead to lower levels of trust, with lower participation rates. The low levels of trust found in distressed areas often have a long history with deep roots in the community. This entrenchment makes speedy change difficult.

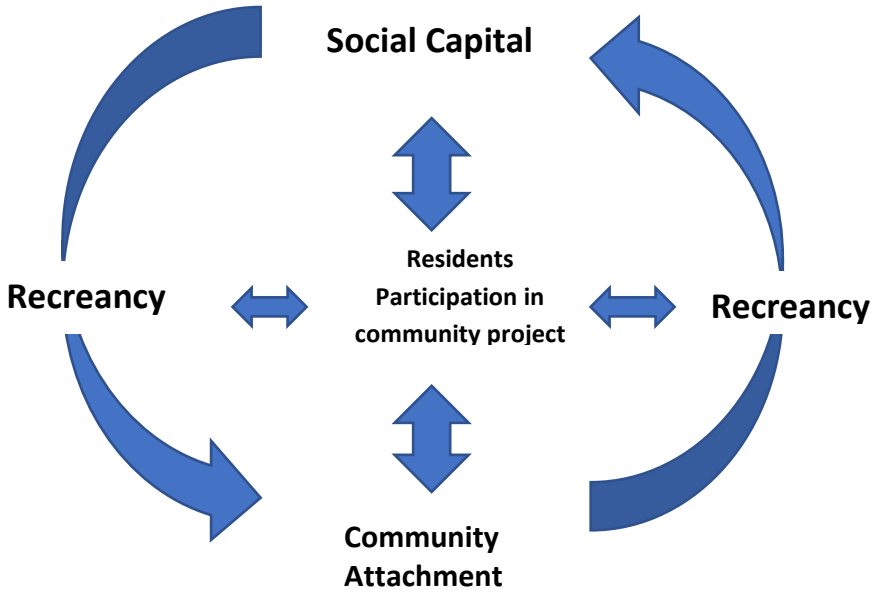


Figure 3.1: The relationship between Social Capital, Community Attachment, and Perception of Recreancy

From Figure 3.1 above, I proposed that social capital, community attachment, and perception of recreancy are mutually inclusive. An increase in social capital, community attachment, and perception of recreancy increase community participation in projects that solve their problems. This will increase psychosocial stress in the residents when they are faced with a stressor, in this case, the threat from the negative impacts of hydraulic fracturing.

3.6 Chapter Summary

This chapter forms the theoretical basis for chapter seven. This chapter suggested that three important sociological concepts; community attachment, social capital, and perception of

recreancy, may explain variation in hydraulic fracturing related stress among residents at Preston-New-Road. In particular, this chapter demonstrated why each theoretical concept is hypothesized to be related to the IES-R.

The next chapter is the stress chapter, and it answers research questions one (Is there theoretical justification for applying the IES-R literature to hydraulic fracturing**).** It discusses what psychosocial stress is, and the instrument used to measure psychosocial stress, i.e., IES and IES-R. The chapter starts by taking a general overview of the relationship between the environment and stress, and narrows down to stress and psychosocial stress, and then the IES and IES-R

4.0 CHAPTER FOUR: PSYCHOSOCIAL STRESS AND THE IMPACT OF EVENT SCALE

4.1 Introduction

This chapter focuses on answering Research Question one: **Is there a theoretical justification for applying the IES-R literature to hydraulic fracturing?** To answer this research question, the utility of the IES is examined by working from the general evidence of an association between stress and the environment to the likelihood of an association between hydraulic fracturing and stress.

The chapter is divided into two parts. Part I starts with the general relationship between the environment and stress by looking at examples of biodiversity loss and climate change (including related weather events) that are often linked to psychosocial stress. This more extensive review of biodiversity and climate change sets the stage for a review of the more specific case of the relationship between hydraulic fracturing and stress-tested in the Preston-New-Road community, suggesting that stress and hydraulic fracturing are related as the emerging literature in the area suggests. The chapter also presents a general overview of stress and the types of stress.

Part II of this chapter examines the literature to determine how the IES-R has been applied in previous and current cases to explore traumatic events in communities. The chapter then narrows down to the instrument used to measure and understand stress (i.e., the IES) and traces how the IES has developed and been modified into the Revised Impact Event Scale (IES-R). The chapter concludes by suggesting that the IES can be used to assess stress associated with shale gas development.

4.2 PART ONE

Psychological effects associated with degradation of the environment is not without precedents, as studies across the globe have found that environmental degradation is linked to higher levels of psychological distress (Crighton et al., 2003; Van Haaften, 1996; Van Haaften & Van De Vijver, 2003; Van Haaften & Van de Vijver, 1996; Van Haaften et al., 2004).

The health effects of environmental degradation have been conceptualized along a continuous sequence from sudden, immediate, traumatic, physical and emotional impacts, i.e., the 2004 Indonesia earthquake, and subsequent tsunami; to less acute processes such as drought, which may be associated with continual physical and psychological exhaustion (Cook et al., 2008; Were, 1989). A few studies explored the psychological effects of a sudden loss or threat of loss of essential elements of daily life, such as means of subsistence or traditional ways of life.

Psychological quality of life is linked to people's sense of place (Ogunseitan, 2005), and environmental degradation influences this relationship (Rogan, 2005). The concept 'solastalgia' was raised by Albrecht (2005, 2000) and Albrecht et al., (2007) to refer to the pain or sadness caused by the loss or lack of solace and sense of isolation due to the present state of one's home and territory. Those who experience solastalgia can experience distress which can escalate to serious health problems such as depression and suicide (Albrecht, 2006; Higginbotham et al., 2006).

Rogan et al. (2005) found that environmental degradation influenced the way people structure their relationship with their surroundings. A lot of factors causes environmental degradation. However, biodiversity loss and climate change are very prominent. The next

sections will discourse the effect of biodiversity loss and climate change on psychosocial stress.

4.2.1 Biodiversity Loss and Health

Natural environments and frequent contact with nature have beneficial effects on human health and well-being (Hartig et al., 2014; James et al., 2015; Lee & Maheswaran, 2011; MacKerron & Mourato, 2013; Mantler & Logan, 2015). The physical and mental health benefits associated with the interaction with natural and human-made green environments depend, in the first place, on the duration and timing of the exposure (Cox et al., 2017; Shanahan et al., 2016).

Short-term exposure to forests, urban parks, gardens and other (semi-) natural environments reduces stress and depressive symptoms, restores attention fatigue, increases self-reported positive emotions and improves self-esteem, mood, and perceived mental and physical health (Barton & Pretty, 2010; Bowler et al., 2010; Tzoulas et al., 2007; van den Berg et al., 2015; van den Bosch & Ode Sang, 2017). Access to natural environments also tends to enhance outdoor physical activity, thereby improving physical health, for instance, by reducing the prevalence of obesity and type 2 diabetes (Calogiuri & Chroni, 2014; Dadvand Payam et al., 2014; Lachowycz & Jones, 2011; Shanahan et al., 2016; Zhang et al., 2017).

Long-term exposure to natural environments, such as residing in areas with high greenness or diverse landscapes, has been associated with reduced respiratory, cardiovascular and cancer mortality (Gascon et al., 2015), and improve respiratory and mental health (Gascon et al., 2015; Liddicoat et al., 2018). The effects of ‘chronic’ exposure to green spaces have been investigated over varying spatial scales, and positive effects of green spaces have been demonstrated over distances ranging between 150 m and 5 km (Browning & Lee,

2017; Dadvand et al., 2016; Demoury et al., 2017; Liddicoat et al., 2018; Triguero-Mas et al., 2015).

Exposure to green or natural environments is significant during prenatal development and early life. The greenness of mothers' neighbourhoods positively affects their infants' birth weight (Dzhambov et al., 2014). Childhood exposure to natural environments reduces the risk of developing schizophrenia (Engemann et al., 2018). Residential greenness has been associated with reductions in obesity prevalence and atopic sensitization in children (Dadvand Payam et al., 2014; Ruokolainen et al., 2015) and positively affect blood pressure in adolescents (Bijnens et al., 2017).

Early-life exposure to natural environments also has many critical long-term effects. Exposure to beneficial microbiota in the environment during early life has a profound impact on the development of the immune system and the prevalence of chronic inflammatory diseases (Flandroy et al., 2018; Jackson et al., 2017; Lasse Ruokolainen et al., 2016; Lasse Ruokolainen, 2017). Early exposure to nature amplifies the potential beneficial effects of green spaces in later life (van den Berg et al., 2016), including the stress-reducing effects of therapeutic immersion in nature (den Berg 2017; Hansen et al., 2017). Conversely, the lack of interaction with nature during early life, for instance, due to the limited time spent in nature or green space in urbanized environments, has been associated with many emotional, cognitive, and physical difficulties in children. The set of mental disorders linked to this disconnection with nature has been described as ‘nature deficit disorder (NDD) (Louv, 2010).

Human encroachment into natural ecosystems is causing biodiversity degradation. Human beings are an integral and inseparable part of the natural world. Human health depends ultimately on its species' health and the natural functioning of its ecosystem. Disturbance

of natural habitats alters the biodiversity of the region both structurally, and functionally. Such alteration of an ecosystem leads to the reduction of some of the organisms' abundances while causing an increase in others' population. The cumulative effect of all these changes leads to diseases transmission dynamics in the given area (Gómez & Nichols, 2010). Ever-increasing population and unplanned development lead to encroachment of natural habitats of ecosystems that are deleteriously affecting the well-being of wildlife species.

Increased proximity between human settlement and wildlife leads to rising disease transmission rates between domestic animals and wildlife. According to Murray et al. (1995), altering natural habitats by man leads to an increase in the risk of an epidemic which can be evidenced through reports of Nipah and Hendral[17] viral outbreaks. Such outbreaks are attributed to forests that have affected the roosting site for fruit bat species which is the reservoir for these pathogens. Fruit bats have shifted to the fruit trees in human settlements, increasing the contacts between human, and bats leading to a disease outbreak.

Biodiversity loss can lead to the emergency and transmission of infectious diseases (Johnson et al., 2013; Keesing et al., 2010) and cause health defects through the loss of food or nutritional diversity (James et al., 1997). Notwithstanding, biodiversity gain can have a direct health benefit. For instance, increasing plant abundance can reduce the negative impacts of pollution (Rowe, 2011), thereby reducing the incidences of respiratory and cardiovascular diseases (Brunekreef & Holgate, 2002). All aspects of human well-being depend on ecosystem goods and services, which in turn depend on biodiversity. Biodiversity loss can destabilize ecosystems, promote outbreaks of infectious disease, and

[17] Nipah and Hendra viruses are two related zoonotic pathogens that have emerged in the Asia-Pacific region.

undermine development progress, nutrition, security, and natural disasters protection. Access to enough, quality and diversity of foods, clean air, fresh water, medicines, and healthcare are not only central to maintaining healthy populations; they are foundational pillars of sustainable development. Meeting these needs while facing the persistent challenges of biodiversity loss, ecosystem degradation, emerging disease pandemics and shifting disease burdens is essential in ensuring human existence on Earth.

4.2.2 Climate Change and Mental Health

An essential aspect of environmental degradation that affects mental health is climate change. It is well understood that human health is threatened by climate change impacts (Costello et al., 2009; World Health Organisation, 2015). In the 2017 Lancet Countdown on Climate Change and Health, authors state: “The human symptoms of climate change are unequivocal and potentially irreversible - affecting the health of populations around the world today” (Watts et al., 2018, p.1).

Climate change is no longer a looming threat but rather a destructive reality with dire predictions for the future. The World Health Organization (WHO) estimates an increase of 250,000 excess deaths per year between 2030 and 2050 due to the well-understood impacts of climate change (Watts et al., 2018). Impacts include heat-related morbidity and mortality, increases in vector-borne diseases (e.g. dengue fever, malaria), increased respiratory illness, and morbidity and mortality due to extreme weather events (Berry et al., 2014). The lesser-known, and often overlooked, effects of climate change include the risks and impacts to mental health, which is the focus of this thesis.

Mental health refers not just to mental illness, mental problems, and mental disorders, but also includes states of mental wellness, emotional resilience and psychosocial wellbeing (Friedli, 2017; Haigh et al., 2014). Psychosocial wellbeing is the interplay between social

and psychological conditions that shape human welfare; a broad term encompasses the states of being mentally healthy, experiencing mental problems, and mental illness (Costello et al., 2009; Friedli, 2017; Haigh et al., 2014).

The expanding research literature on climate change and mental health includes increasing evidence that extreme weather events, which are more frequent, intense, and complex under a changing climate, can trigger post-traumatic stress disorder (PTSD), major depressive disorder (MDD), anxiety, depression, complicated grief, survivor guilt, vicarious trauma, recovery fatigue, substance abuse, and suicidal ideation (Berry et al., 2008; Berry et al., 2010; Berry et al., 2014; Bourque & Willox, 2014; Costello et al., 2009; Cunsolo Willox et al., 2012, 2015; Cunsolo Willox et al., 2013; Cunsolo Willox et al., 2013; Doherty & Clayton, 2011).

Incremental climate changes, such as rising temperatures, rising sea levels, and episodic drought, can change natural landscapes, disrupt food and water resources, change agricultural conditions, change land use and habitation, weaken infrastructure and give rise to financial and relationship stress, increase risks of violence and aggression, and displacement of entire communities (Agnew, 2012; Willox et al., 2013; Nurse et al., 2010).

The overarching threats of a changing climate can also incite despair and hopelessness as actions to address the ‘wicked problem’ of climate change seem intangible or insignificant compared to the threats' scale and magnitude (Albrecht, 2011). Paradoxically, these same disastrous circumstances may also inspire altruism, compassion, optimism, and foster a sense of meaning and personal growth (otherwise referred to as post-traumatic growth) as people band together to salvage, rebuild, and console amongst the chaos and loss of a changing climate (Ramsay & Manderson, 2011).

Exploring the Relationship between Mental Health and Climate Change

An updated overview of recent evidence on climate change's mental health implications is timely given the ongoing, rapid expansion of research in the broad field of health and climate change and increasing public concern about climate change trends and risks (World Health Organisation, 2015). Since 2007, media reports on climate change and health have increased by 78% and the academic literature on climate and health issues has tripled (Watts et al., 2018).

There is also increasing public and academic recognition of the extent to which rising global temperatures threaten planetary and human health (Hancock et al., 2015; Horton et al., 2014). While public awareness about the health implications of climate change continues to grow, the topic of mental health is frequently absent from this discourse. In some ways, this reflects the global discourse, where mental health, in general, has been neglected in comparison to physical health. Globally, the prevalence of mental health issues is too high, even without considering the added mental health consequences of a changing climate. A 10-year systematic analysis of the global burden of disease from 1990 to 2010, Murray et al. find that mental illness comprises 7.8% of the worldwide disease burden (Murray et al., 2012).

Mental and behavioural disorders also account for the most significant global burden of years lived with a disability (Becker & Kleinman, 2013). Vigo et al. contend that these figures are much higher if co-morbidities related to mental illness are considered within the burden of illness studies. A more accurate definition of mental illness is used, a description that includes health behaviours like self-harm and suicide (Vigo et al., 2016). The failure of global investment in mental healthcare to address the consequences and impacts of rapidly escalating levels of mental illness has been described as a ‘global tragedy’ reflecting a long “legacy of the neglect and marginalization of mental health” (Becker &

Kleinman, 2013, p9). Similarly, authors from the 2016 Lancet report on sustainable development and global mental health describe the state of mental health as the "most neglected of all human health conditions" and a "failure of humanity" (Patel et al., 2016, p105).

The inattention to mental health is of particular concern in the field of climate change and mental health given the evidence that psychological impacts from any form of a disaster exceed physical injury by 40–1 (Links, 2017), and that since the year 2000, the frequency of climate change-related weather disasters has increased by 46% (Watts et al., 2018). Crucially, it is the most marginalized who are especially vulnerable to climate change's impacts on mental health. McMichael notes that climate change acts as a health "threat amplifier", compounding existing social injustices (McMichael, 2017, p.8). Therefore, there is a strong case for exploring and communicating research and policy learning about the relationship between climate change and mental health - especially as the topic area pertains to health equity.

Current Risks and Impacts of Climate Change on Mental Health

It is challenging for people to recognise climate changes because they appear distant or abstract, mostly because the climate is often confused or lost in perceptions about the weather or seasonal change (Hayes & Poland, 2018). The influential sociologist, Anthony Giddens, refers to this space and time distancing of the climate change problem as the Giddens Paradox (Giddens, 2011). The Giddens Paradox states that: "since the dangers

posed by global warming aren't tangible, immediate or visible in the course of day-to-day life, many will sit on their hands and do nothing of a concrete nature about them. Yet waiting until such dangers become visible and acute, in the shape of catastrophes that are

irrefutably the result of climate change, before being stirred to serious action will be too late" ((Giddens, 2011, p.2).

Marshall contends that part of the time and space distancing of the climate change problem, and thus the reluctance to act, is reinforced by the Western political discourse on climate change as a future-facing problem that intentionally overlooks the centuries of industrialization, fossil fuel consumption, and land degradation that contribute to anthropogenic climate change (Marshall, 2015). Marshall calls for a reckoning with this discourse by noting:

> Climate change is a future problem. But it is also a past problem and a present problem. It is better thought of as a developing process of long-term deterioration, called, by some psychologists, a "creeping problem." The lack of a definite beginning, end, or deadline requires that we create our own timeline. Not surprisingly, we do so in ways that remove the compulsion to act. We allow just enough history to make it seem familiar but not enough to create a responsibility for our past emissions. We make it just current enough to accept that we need to do something about it but put it just too far in the future to require immediate action (Marshall, 2015, p.1).

Noting the Giddens Paradox and the reckoning that Marshall asks us to have with the 'creeping problem', of climate change, it becomes crucial to confront the current mental health consequences related to climate change that are happening now (Giddens, 2011; Marshall, 2015). To do so, it is useful to explore the conceptual framework of climate change and mental health developed by Berry et al. (Berry et al., 2010). These authors organize climate change-related hazards into three categories: acute (flooding, hurricanes, etc.), sub-acute (pervasive drought), and chronic (rising sea-level, increasing temperatures). These climate change-related hazards lead to various direct, indirect, and overarching psychosocial consequences that are occurring now, disproportionately affecting those most marginalized.

Direct psychosocial consequences of climate change include trauma related to extreme weather events, like floods, hurricanes, wildfires, and heat waves (Berry et al., 2010; World Health Organisation, 2015). Indirect mental health consequences of climate change occur through social, economic, and environmental disruptions (e.g. famine, civil conflict, displacement, and migration) related to a changing climate (Berry et al., 2010; Fritze et al., 2008). The overarching psychosocial consequences of climate change relate to the long-term emotional distress caused by an awareness of the threats and impacts of climate change on the earth's current and future well-being and its inhabitants. The multidimensional climate change and mental health pathway lead to a variety of unequal psychosocial consequences explored below.

Direct Mental Health Consequences of Climate Change

There is now an extensive and rapidly expanding body of research exploring the current mental health consequences of climate change-related extreme weather events. Extreme heat events and humidity have been noted to increase hospital admissions for mood and behavioural disorders, including schizophrenia, mania, and neurotic disorders (Berry et al., 2014; Wang & Horton, 2015).

Scholars in the field note that heat-related mental health morbidity tends to occur most often in people with impaired thermoregulation, namely people with pre-existing mental health illness and problems, people taking prescription medications (specifically lithium, neuroleptic and anticholinergic drugs), and those with substance abuse (alcohol and drugs) problems (Cusack et al., 2011; Dodgen et al., 2016; Page et al., 2012). Extreme heat is also linked with an increased risk of wildfires, which also directly impact mental health. Bryant et al. mapped the Black Saturday bushfires' psychological outcomes in Victoria, Australia;

in communities most at risk of bushfires' impacts. These authors found incidences of PTSD, psychological distress, and depression related to the fires (Bryant et al., 2014).

The direct mental health consequences related to flooding and hurricanes are also well documented (see (Alderman et al., 2013; Azuma et al., 2014; Burton et al., 2016; Fernandez et al., 2015; Galea et al., 2007; Haskett et al., 2008; Neria & Shultz, 2012; Rhodes et al., 2010; Stanke et al., 2012; Tunstall et al., 2006; Waite et al., 2017; Whaley, 2009)). In a study of 30 locations in England and Wales, Tunstall et al. conducted interview surveys with residents affected by flooding. They found that psychological impacts were commonly reported than physical effects (Tunstall et al., 2006).

One study researching the psychosocial consequences following Hurricane Katrina estimates that 20–35% of survivors experienced some form of mental health issue following the disaster (Whaley, 2009). Galea et al. reported a 31.2% prevalence of anxiety-mood disorders amongst Hurricane Katrina survivors (Galea et al., 2007), while Rhodes et al. found that nearly half (47.7%) of marginalised community members of New Orleans (mainly low-income, African American women) showed probable signs of PTSD after Hurricane Katrina (Rhodes et al., 2010).

While PTSD is often reported as one of the most severe mental health impacts related to acute climate change-related disasters, there have also been increasing reports of suicide and suicidal ideation following extreme weather events. Chand et al. note one Italian study that found higher rates of suicide in northern communities with more significant climate variability (Hayes et al., 2018; Preti & Miotto, 1998). Dodgen et al. highlight the risk of homicide-suicides after extreme weather events by noting the doubling of these incidents following Hurricane Andrew in 1992 in Miami-Dade County (Dodgen et al., 2016). There is also observed evidence of increased suicidal thoughts (from 2.8 to 6.4%) and plans to

commit suicide (from 1.0 to 2.5%) 18-months after an extreme weather event (Dodgen et al., 2016). Notably, however, the overall evidence linking changing climate and suicide is still inconclusive.

Studies on suicidality in natural disaster contexts, for example, vary considerably in study methodology and timeframes considered, with recent reviews indicating divergent trends in suicidality rates following exposure to extreme events, ranging from an initial decline, to neutral effects, all the way to a delayed increase in suicidality (Reifels et al., 2018). On a deeper level, the psychological responses of communities and individuals to disasters are complex and varied. Rebecca Solnit, in 'A Paradise Built in Hell', usefully describes the complicated psychosocial consequences that can arise after an extreme weather event as, "that sense of immersion in the moment and solidarity with others caused by the rupture in everyday life, an emotion graver than happiness but profoundly positive. We do not even have a language for this emotion, in which the wonderful comes wrapped in the terrible, joy in sorrow, courage in fear. We cannot welcome disaster, but we can value the responses, both practical and psychological" (Solnit, 2010, p9). Exploring the complexity of psychological responses in the book, 'Climate change and human well-being', Weissbecker discussed the full spectrum of psychosocial consequences of climate change-related events ranging from mental illness to more positive experiences like 'Post Traumatic Growth' (PTG), empathy, compassion, altruism, and emotional resilience (Weissbecker, 2011).

Indirect Mental Health Consequences of Climate Change

The indirect mental health consequences of climate change can occur due to damages to physical and social infrastructure, physical health effects, food and water shortages, conflict, and displacement from acute, subacute, and chronic climactic changes (Berry et

al., 2010). One of the most well-documented climate hazards that indirectly influences mental health is drought. Long-term droughts affect food and water supplies and subsequently affect land-based workers' economic and mental well-being, most often impacting those living in rural and remote communities (OBrien et al., 2014; Vins et al., 2015; Yusa et al., 2015). In a quantitative analysis of drought and distress in Australia over seven years, authors found that rural dwellers experience more distress due to the droughts than their urban counterparts (OBrien et al., 2014).

In a systematic review of the literature, authors note the most prominent causal pathway linking drought and mental health is via the economic effects of land degradation (OBrien et al., 2014). These effects are most prominent amongst farmers whose economic livelihoods depend on environmental conditions. Exemplifying this, a 2008 study in New South Wales, Australia reports that nearly three-quarters of farmers report stress related to persistent drought (Stain et al., 2008). Some authors also suggest that income insecurity related to drought increases the risk of suicide among farmers (Butler, 2014; Ellis & Albrecht, 2017).

Long-term drought has also been increasingly linked to conflict and forced migration, influencing psychosocial outcomes like the propensity for stress, PTSD, anxiety, and trauma (Gleick, 2014). The Institute for Environment and Human Security of the United Nations University estimates that migration due to climate change may vary drastically, citing estimates of between 25 million to 1 billion by 2050, with 200 million as the most frequently cited estimate (IEHS, 2015). The rise in the number of ‘climate migrants’ has been identified as a significant risk by an increasing number of defence and security experts (Gemenne et al., 2014). Gleick postulates that the civil conflict in Syria can be traced to the agricultural failures in the years 2006–2009 and the returning drought in the

year 2011(Gleick, 2014). In 2011, over 1.5 million Syrians moved from rural, agricultural areas to urban areas seeking refuge from the pervasive drought, failed agriculture, and lack of food and water (Gleick, 2014).

Pervasive ecological degradation, the inadequate policy response to water and food insecurity, and ongoing tensions between rural and urban community members have arguably contributed to civil unrest and the ongoing conflict in Syria (Gleick, 2014). According to the United Nations, the number of displaced Syrians has reached over 5 million people in the past five years (Aljazeera., 2017).

Migration from a war-torn country to a host country where culture, language, and lifestyle may be vastly different may also contribute to psychosocial malaise as displaced migrants can face stressors associated with xenophobia and racism from people in their new host country (Gleick, 2014). Conversely, as Siriwardhana and Stewart noted, the displacement may also support psychosocial resilience by fostering hope and belonging for refugees in host countries where they feel welcomed, safe, and experience better living conditions (Siriwardhana & Stewart, 2013).

At the community level, the indirect mental health consequences of climate change are understudied. These consequences may include things like a diminishment in community cohesion, the loss of community identity, threats to a sense of continuity and sense of belonging as people are forced to move in and out of communities because of environmental stressors, and an undermining of cultural integrity if people have to leave their homelands (Hayes & Poland, 2018). Migration challenges the identity, sovereignty and heritage of people who have to leave their homelands. It also challenges the integrity and continuity of people's traditional ways of life. Threats to community health also include an increased likelihood of criminal behaviour, violence and aggression as

community members experience various stressors related to climate change (Hayes & Poland, 2018).

Psychological Consequence of Fracking

There have been suggestions for stress related to fracking. Living near a fracking site can likewise be stressful (Morgan et al., 2016). For instance, Ferrar et al. (2013) found that stress was one of the most frequent outcomes described by residents living near active hydraulic fracturing sites. Research also documents that adverse mental health outcomes are related to both the distance individuals reside from hydraulic fracturing wells and those wells' size (Casey et al., 2018). Notably, the announcement of shale gas development within a community can be viewed differently by residents. The existing literature suggests four different ways people residing near shale gas development activities perceive it as threatening and distressful.

First, residents are often concerned about their health (Casey et al., 2018; Drummond & Grubert, 2017; Fisher et al., 2018; Perry, 2012a). Second, residents worry about physical impacts associated with unconventional hydraulic fracturings such as light, noise and induced earthquakes (Drummond & Grubert, 2017; Evensen & Stedman, 2018; Fisher et al., 2018; Korfmacher et al., 2013). Third, residents may be anxious about changes to their way of life that harm the social and natural environment (Drummond & Grubert, 2017; Lai et al., 2017; Perry, 2012b). Fouth, residents who attempt to resist shale gas development can also experience high distress levels when interacting with industry, regulators, planners, and government concerning developments in their communities (Bassett et al., 1987; Muncie, 2020; Pines, 1994; Trevisan, 2020).

This section described stress and the environment and tried to link these two phenomena. Psychosocial stress has an environmental linkage, and most psychosocial stress emanates

from environmental phenomena such as environmental degradation, loss of biodiversity, and climate change. The next section discusses the community impacts of hydraulic fracturing. Before I discuss the origin, development, relevance, and use of the IES as an instrument for measuring psychosocial stress, I will discuss the various stressors and psychosocial stress.

4.2.3 Stress and Types of Stress

Stress is the body's reaction to any change that requires an adjustment or response. The body reacts to these changes with physical, mental, and emotional responses. Stress is a normal part of life. You can experience stress from your environment, body, and thought (Cleveland Clinic Medical Professional, 2015).

The human body is designed to experience stress and react to it. Stress can be positive, keeping us alert, motivated, and ready to avoid danger. Stress becomes negative when a person faces continuous challenges without relief or relaxation between stressors (Dickerson & Kemeny, 2004). As a result, the person becomes overworked, and stress-related tension builds.

The body's autonomic nervous system has a built-in stress response that causes physiological changes to allow the body to combat stressful situations. This stress response, also known as the 'fight or flight response', is activated in case of an emergency. However, this response can become chronically activated during prolonged periods of stress. Prolonged activation of the stress response causes wears and tear on the body – both physical and emotional (Brewin, 2001).

Stress that continues without relief can lead to a condition called distress – a negative stress reaction. Distress can disturb the body's internal balance or equilibrium, leading to

physical symptoms such as headaches, an upset stomach, elevated blood pressure, chest pain, sexual dysfunction, and problems sleeping (Dickerson & Kemeny, 2004). Emotional problems can also result from distress. These problems include depression, panic attacks, or other forms of anxiety and worry. Research suggests that stress also can bring on or worsen specific symptoms or diseases. Stress is linked to six of the leading causes of death: heart disease, cancer, lung ailments, accidents, cirrhosis of the liver, and suicide (Dickerson & Kemeny, 2004).

Stress also becomes harmful when people engage in the compulsive use of substances or behaviours to relieve their stress. These substances or behaviours include food, alcohol, tobacco, drugs, gambling, sex, shopping, and the Internet (Koob, 2009). Rather than relieving the stress and returning the body to a relaxed state, these substances and compulsive behaviours tend to keep the body in a stressed state and cause more problems. The distressed person becomes trapped in a vicious circle.

Psychosocial Stress and Physiological Stress

In everyday life, we are confronted with social, cognitive, or physiological stressors in various situations. Various stressor types that are associated with potential threat can induce stress (Selye, 1998). The bodily stress reaction activates the hypothalamic-pituitary-adrenal gland (HPA) axis and subsequently releases cortisol (Kirschbaum et al., 1993). The homeostatic psychological process is also altered by stress (Burchfield, 1979; Koob, 2009). Thus, the stress response is linked to a state of arousal and hyper mobilization of the body's normal activation and emotional system (Koob, 2009). According to this view, the two distinct types of stressors are physiological stress and psychosocial stress.

Physiological stress is indicated by an unpleasant sensory, emotional and subjective experience associated with potential damage of body tissue and bodily threat (Peyron et al.,

2000; Price, 2000; Tracey, 2005). Different physical conditions may fulfil these criteria, e.g. pain, hunger, oxidative stress, etc. (see, e.g., Colaianna et al., 2013). Psychosocial stress is induced by social threat situations, including social evaluation, social exclusion and achievement conditions claiming goal-directed performance (Dickerson & Kemeny, 2004; Pruessner et al., 1999). The need to be affiliated with others and maintain the social-self are core psychological needs (Dickerson & Kemeny, 2004; Panksepp, 2003; Tossani, 2013). If the gratification of these needs is threatened, for example, by a negative judgment of performance by others, then social threat and therefore, stress is induced (Dickerson & Kemeny, 2004).

Social evaluation and cognitive achievement with unpredictable outcomes induce heightened cortisol responses, accompanied by increases in electrodermal activity, subjective stress reports and negative affect (Dedovic et al., 2009; Dickerson & Kemeny, 2004; Eisenberger & Lieberman, 2004). Individuals with higher sensitivity towards social evaluation also express elevated cortisol response to acute stressors such as an achievement or social exclusion (Kirschbaum et al., 1995; Pruessner et al., 1999; Seidel et al., 2013).

4.2.4 Psychosocial Stress in Community

Psychosocial stress levels of community members may be increased due to extractive activities. According to Scott (2017, p5), psychosocial stress is “the result of a cognitive appraisal (your mental interpretation) of what is at stake and what can be done about it”. This results when we look at perceived social stress in our lives and discern that it will require resources we do not have (Scott, 2017). Anything that translates to a (perceived) threat to our social esteem, social status, acceptance/rejection within a group, respect, or a danger that we feel we have no control over can elicit psychosocial stress.

Many of the social impacts discussed in previous chapters of this thesis, likely also elicit stress among residents living in resource extraction communities. There have been many concerns about the environmental, social and health impacts of unconventional gas extraction. These concerns can be felt as soon as there are rumours of the intervention, much earlier than when the actual project starts. These rumours create uncertainty in local community members' minds and subsequently fear, anxiety, and anger may set in (Vanclay, 2012).

For example, research on the social impacts of an earthquake caused by gas extraction in the Netherlands found that most residents complained of health issues such as depression, anxiety, insomnia and stress (van der Voort & Vanclay, 2015). The media can also generate stress in resource extraction communities. Media attention in a community may create a situation where residents continuously talk about fracking's effects on their life to the media generating uneasiness and discomfort. When this continues over time, it leads to a diverse range of physical and mental ailments (Wilkinson & Marmot, 2003). These possible impacts may increase residents' stress due to the increased uncertainty that resource extraction brings.

These resources are threatened by environmental factors which trigger depletion or loss of resources acquired by an individual or an entire community. Social and environmental factors may threaten people’s position, status, loved ones, economic stability, self-esteem or fundamental belief. These perceived threats are essential to people because they have instrumental value and have a symbolic value that helps define their identity (Cooley, 1922; Erikson, 1968; James, 1890). The loss of these resources may create stress in a community. In this thesis, the Revised Impact of Event Scale (IES-R) was used to measure the level of psychosocial stress in the fracking community. The next section describes the Impact of Event Scale and its revised form, i.e., the Revised Impact of Event Scale

4.2.5 Origin and History of the Impact of Event Scale (IES)

The human response to stress research required an evaluation of serious life events and their subjective impacts. Though the evaluation of real-life event is complex, it is now possible through questionnaires that list situational changes and produces quantitative estimates of the cumulative impacts on individuals or groups (Birley, 1975; Horowitz et al., 1977). A vital component that is needed is a useful instrument that measures the current degree of subjective impact experienced from the specific event.

Such a tool will enable investigators and researchers to observe individuals over some time following the occurrence of an event, "compare subgroups for the degree of subjective distress after a particular life event, or contrast life events in terms of their relative impact on different populations" (Horowitz et al., 1979, p1). Because of this, Moos (1974) reviewed various methods but found no suitable measurement for this purpose. However, an instrument known as the Texas Inventory of Grief was inverted by Faschingbauer et al. (1977). Although this instrument does explore the kind of conscious experience that a person can describe, it is limited to bereavement.

Horowitz et al. (1979) in 1979 developed a more broadly applicable instrument called the Impact of Event Scale. This scale is used to assess subjective distress for any life event. This instrument's wording is not anchored to a specific occurrence; however, it applies to the "particular qualities of conscious experience that encompass all such events" (Horowitz et al., 1979, p1).

Their study of psychological responses to stressful life events found typical quantities of conscious experience among patients with different personality styles. Because of this, two major response sets were abstracted from in-depth evaluation and psychotherapy: 'intrusion and avoidance' (Horowitz et al., 1979, p1). These response sets and how they

were experienced, were also prominent in other reports of psychological reactions to stress (Horowitz, 1986; Janis, 1969; Lazarus, 1966; Lindemann, 1944b).

The intrusion response is characterised by unbidden thoughts and images, intense pangs of waves of feelings, troubled dreams, and repetitive behaviours. Avoidance response is also characterised by a denial of an event's meaning and consequences, ideational construction, behavioural inhibition or counter phobic activity, and awareness of emotional numbness (Horowitz et al., 1979). Items for this self-report instrument were derived from statements most frequently used to describe distress episodes by persons who had experienced recent life changes (Horowitz, 1974; Horowitz, 1973).

The list that evolved in this way contained experiences of a particular quality, such as intrusiveness, worded so that they might apply to any event. To anchor the qualities of experience to a particular context, the life event specific to each person was entered at the top of the form and served as a referent for each of the list's statements. Guided by clinical experience, the various items were divided into two subgroups, intrusion, and avoidance.

The goal was a scale that would provide sub-scores for these response sets and a total subjective stress score. Since persons cannot report the unconscious aspects of the denial process, but only the ‘felt’ consequences, such as numbness, the term ‘avoidance’, rather than ‘denial’ is used to describe this subscale (Horowitz et al., 1979). Over several years various forms of this item list were given to psychotherapy patients with stress response syndromes and non-patient volunteers exposed to severe life events.

The wording and the format were revised during the run of this trial, and it was determined through this process that the best time unit for clinically valid reports of a person's current response level was ‘the past week’. Subjects reported forgetfulness and less conviction about intervals more extended than a week, and a constriction in reporting significant

episodes felt to be markers of their current level of stress for a period of less than a few days (Horowitz et al., 1979).

Measurement of the IES

The IES is a broadly applicable self-report measure designed to assess current subjective distress for any specific life event (Corcoran & Fischer, 1987; Horowitz et al., 1979). It is an instrument that can be used for repeated measurement over some time. Its sensitivity to change renders it useful for monitoring the client's progress in therapy (Corcoran & Fischer, 1987). The IES scale consists of fifteen items, seven of which measure intrusive symptoms (intrusive thoughts, nightmares, intrusive feelings and imagery), eight measures avoidance symptoms (numbing of responsiveness, avoidance of feelings, situations, ideas). These two combined provide a total subjective stress score.

All IES items are anchored to a specific stressor (Birley, 1975; Horowitz et al., 1979). Respondents are asked to rate the items on a 4-point scale according to how often each has occurred in the past 7 days. The 4 points on the scale are 0 (not at all), 1 (rarely), 3 (sometimes), and 5 (often). The score on the IES ranges from 0 – 75. They are interpreted as follows

0 - 8	No meaningful impact
9 - 25	Impact event – you may be affected
26 - 43	Powerful impact event – you are certainly affected
44 - 75	Severe impact event - this is capable of altering your ability to function

Table 4.1: Interpretation of the IES- scale.

Scores above 26 are very significant on the IES scale. For instance, a score of 27 and above means a 75% chance that you have PTSD. Those who do not have full PTSD may

have partial PTSD, or at least some symptoms (Coffey et al., 2006). A score of 35 and above represent the best cut off for a probable diagnosis of PTSD (Neal et al., 1994).

The validity of the IES

Criterion (or Predictive) Validity: The IES is found to be sensitive to change, in terms of detecting changes in clinical status over time, and in terms of detecting the relevant differences in response to traumatic events of varying severity by different groups (Corcoran & Fischer, 1994; Weiss & Marmar, 1997). Corcoran & Fischer (1994) noted the significant changes in the IES subscales scores of outpatients being treated for bereavement throughout treatment.

This sensitivity to movement was reported by Horowitz et al. (1979) in their study of 32 subjects with stress response syndromes. The IES was administered twice to each subject with a mean time of 11 weeks between first and second administration. The IES scores' significant change confirmed the prediction of a marked decline in the item, subscale, and overall scores; and supports its validity as a sensitive reflection of change.

Corcoran & Fischer (1994) noted support for the known-groups validity of the IES demonstrated by the significant differences in the scores of outpatients seeking treatment from bereavement and three field samples. Briere (1997) noted that several studies involving combat veterans, natural disaster survivors, emergency services personnel, victims of crime, and adults sexually abused as children, have shown that the IES discriminates various traumatised groups from their non-traumatised cohorts.

This was also shown in the Horowitz et al. (1979) study comparing the IES scores from a sample of patients who had experienced specific traumatic life events with a sample of medical students exposed to cadaver dissection. The major difference in effects was

between the groups (F=212.1,p< 0.0001 for intrusion; F=73.0, p< 0.001 for avoidance; F=170.8, p< 0.0001 for the total stress score). Gender differences were also significant, but with a much smaller size of the effect, with females scoring higher than males.

In a general population study by Briere and Elliott in 1996 (Briere, 1997), they found that Blacks scored substantially higher than Whites on the IES. Although this difference decreased when the relative degree of violence experienced by Whites versus Blacks was controlled for, it did not disappear. Briere suggests that interpretations of IES score differences should always take race into account.

Content Validity: In the original study, Horowitz et al. (1979) developed 20 items in the questionnaire. All the items were endorsed frequently. The items most often endorsed, e.g. 'things I saw or heard suddenly reminded me of it' were acknowledged by 85% of the subject sample (n=66), and the item with the lowest endorsement was acknowledged by 38%. Six items that were most frequently reported had a mean weighted score of 3 or more, indicating that as a group, these subjects experienced such events at a high level of intensity or frequency (Devilly & Spence, 1999).

In a 1982 study by Zilberg, Weiss, and Horowitz (Weiss & Marmar, 1997) of a group of outpatients with pathological grief (n=35) and a group of bereaved field subject volunteers (n=37), it was demonstrated that all items in the IES were endorsed frequently, with a range from 44% to 89% of the pooled sample. The comparison of the rank order of items based on the frequency of endorsement between this study and the initial publication of the IES produced a Spearman rank correlation of .86 (p0.05), suggesting that the content of experience following traumatic events, as represented in the IES item pool, was similar across types of events and patient/nonpatient population (Devilly & Spence, 1999).

It is acknowledged that the 15 items of the IES capture the level of intrusive and avoidance symptomatology in response to a specific stressor as manifest in the past 7 days (Briere, 1997; Weiss & Marmar, 1997). Briere, (1997) suggests that the brevity of the scale, its potentiality limited content domain, and its nonclinical focus renders it useful only as a screen for the presence of non-arousal-related posttraumatic stress, especially if used in isolation from other, more fully validated instruments.

Construct Validity: Cluster Analysis was applied to the original 20 items in the IES by Horowitz and his colleagues. Clusters were determined by a correlational measure of association and an average linkage algorithm. The primary and secondary clusters included 15 of the 20 items. Clusters 3 and 4 contained the five remaining items. The primary cluster had items from the clinically derived intrusion subset, while the secondary cluster contained a clinically derived avoidance subset. This finding was found to support the use of intrusion and avoidance subscales (Horowitz et al., 1979). The number of items was reduced by selecting only those that empirically clustered and had significant item-to-subscale correlations beyond the 0.01 level of significance. The measure of intensity was discarded in favour of a single measure by frequency since scores derived by these variables indicated a degree of similarity that made a dual response for each item unnecessary. Subjects seemed able to score frequency more accurately than intensity (Devilly & Spence, 1999).

Zilberg, Weiss and Horowitz (Weiss & Marmar, 1997) used factor analysis to assess the validity of the items assigned to the intrusion and avoidance subscales. Two factors were extracted via a varimax rotation[18]. The first factor was defined by the avoidance items,

[18] Varimax rotation is a statistical technique used at one level of factor analysis as an attempt to clarify the relationship among factors. Generally, the process involves adjusting the coordinates of data that result from a principal components analysis

with coefficients ranging from .39 to .86. Whilst the intrusion items produced coefficients ranging from .09 to .34. The second factor had higher loadings of intrusion items, with coefficients ranging from .58 to .75, whilst avoidance items had coefficients ranging from .11 to .35. This was seen to show the strong coherence of the two subscale item sets (Devilly & Spence, 1999).

4.2.6 Impact of Event Scale-Revised (IES-R)

Posttraumatic stress disorder (PTSD) was introduced into the world psychiatric nomenclature in 1978 (World Health Organization, 1978) with the publication of the ICD-9, documenting "the cross-cultural recognition of the typical symptomatic response to exposure to traumatic life events" (Weiss, 2007, p219). The characteristic core of the disorder includes the distressing oscillation between intrusion and avoidance.

Intrusion is characterized by nightmares, unbidden visual images of the trauma or its aftermath while awake, intrusive thoughts about aspects of the traumatic event, sequelae, or self-conceptions. Avoidance is typified by deliberate efforts to not think about the event, not talk about the event, and avoid reminders of the event (Horowitz et al., 1979; Weiss, 2007).

Following this conceptualization, Horowitz and colleagues published a simple but powerful self-report measure for assessing the magnitude of symptomatic response in the past 7 days to a specific traumatic life event titled the Impact of Event Scale (IES) (Horowitz et al., 1979). This scale was published before the appearance of the formal diagnostic criteria by the American Psychiatric Association (APA) in 1980 (American Psychiatric Association, 1980). According to the APA, the conditions to be used for diagnosis of PTSD are grouped into categories, and these are:

i. Criterion A: The person was exposed to death, threatened by death, actual or threatened serious injury, or actual or threatened sexual violence in the following ways: direct exposure, witnessing the trauma, learning that a relative or close friend was exposed to the trauma, and indirect exposure to aversive details of the trauma, usually in the course of professional duties (e.g., first respondents, medics etc.)

ii. Criterion B: The traumatic event is persistently re-experienced in the following ways: Unwanted upsetting memories, nightmares, flashbacks, emotional distress after exposure to traumatic reminders, and physical activity after exposure to traumatic reminders.

iii. Criterion C: Avoidance of trauma-related stimuli after the trauma, in the following ways: Trauma-related thoughts or feelings, trauma-related reminders

iv. Criterion D: Negative thoughts and feeling that began or worsened after the trauma, in the following ways: Inability to recall key features of the trauma, overly negative thoughts and assumptions about oneself or the world, exaggerated blame of self or others for causing the trauma, negative effect, decrease interest in activities, feeling isolated, difficulty experiencing the positive effect.

The original IES comprised two subscales: intrusion (the sum of seven items), and avoidance (the sum of eight items) that mapped on to what was described in the B and C criteria of the diagnosis of PTSD – the signs and symptoms of intrusive cognitions and effects together or oscillate with periods of avoidance, denial, or blocking of thoughts and images. The scale used a somewhat unusual response format: Not at all = 0, Rarely =1, Sometimes = 3, and Often = 5. The scale did not assess the third set of PTSD symptoms,

the hyperarousal symptoms presented in the D criterion of the diagnosis of PTSD except for disturbances in sleep. Thus, the phenomena of hypervigilance, angry outbursts, and exaggerated startle response were not covered in the original scale (Weiss, 2007a).

Because of this, in 1997, Daniel S. Weiss and Charles R. Marmar chose to revise the scale by adding seven additional questions to measure another dimension of people's reaction to extreme stress events: the hyperarousal symptoms. The revised impact of event scale is a twenty-two self-reporting measure used to assess how stress is build up after a traumatic event (Wilson & Keane, 2004).

Validity and Reliability of IES-R

The IES-R was designed and validated using a specific traumatic event as a reference in the patient's directions while administering the total and using a particular time frame of the past seven days (Horowitz et al., 1979). The scale discriminates between a variety of traumatized groups and non-traumatized groups in general population studies. The subscales of avoidance and intrusion show internal consistency. While related, the subscales measure different dimensions of a stress response. African American have been shown to score higher than whites on the IES in general population studies, an effect that diminished with increasing relative violence, and this should be taken into account during interpretation. The hyperarousal subscale added by Weiss and Marmar (Weiss & Marmar, 1997) has good subscales, and detect the relevant difference in the clinical response to traumatic events of varying severity.

Strengths and Limitations of IES-R

This revised instrument's main strength is that it is still short, easily administered and scores correlates better with the DMS-IV criteria for PTSD (Briere, 1997; Weiss &

Marmar, 1997), and can be used repeatedly to assess progress. It is still limited by remaining a screening tool rather than a comprehensive test and non-clinical focus. It is always best used for recent not remote traumatic events. The IES-R has been translated into many languages, including Spanish, French, Chinese, Japanese, and German (Christianson, 2015).

Measurement on IES-R Scale

The revised IES scale has seven additional questions and a scoring range of 0 – 88. On this test, scores that exceed 24 can be quite meaningful. A 24 and above score implies PTSD is a clinical concern (Asukai et al., 2002). Those with scores this high who do not have full PTSD will have partial PTSD or at least some symptoms. A score of 33 and above represent the best cut off for a probable diagnosis of PTSD (Creamer et al., 2003). A score of 37 and above is high enough to suppress your immune system even ten years after an impact event (Kawamura et al., 2001). A comparable score on the original IES scale will be 39. The IES-R is very useful in measuring the effect of routine life stress, everyday trauma, and acute stress.

Item response anchors are 0 = not at all; 1 = a little bit; 2 = moderately; 3 = quite a bit; 4 = extremely. The intrusion scale is the mean item response of items 1, 2, 3, 6, 9, 14, 16, and 20. The avoidance scale is the mean item response of items 5, 7, 8, 11, 12, 13, 17, and 22. The hyperarousal subscale is the mean item response of items 4, 10, 15, 18, 19, and 21.

The IES-R and PTSD

The Impact of Event Scale-Revised (IES-R) is one of the commonly used metrics for assessing posttraumatic stress symptomology (Weiss & Marmar, 1997; Weiss, 2007). It has shown validity across different types of trauma. For instance; school shooting

(Suomalainen et al., 2011; Turunen et al., 2014), the September 11th terrorist attack (Callahan et al., 2005), abuse (Ludäscher et al., 2015; Mithoefer et al., 2013; Rash et al., 2008), and natural disasters (Arnberg et al., 2014; Gill et al., 2014; Wang et al., 2011).

The IES was proposed to contain two subscales, intrusion, and avoidance. While some studies found support for this factor structure (Shevlin et al., 2000; van der Ploeg et al., 2004), others identified a third factor: sleep disturbance (Larsson, 2000). With the introduction of the DSM-IV (Armour et al., 2016; Elhai & Palmieri, 2011), the IES was updated to include a hyperarousal subscale. The factor structure of the new scale, the IES-Revised has also received attention. In general, studies do not find strong support for the three proposed subscales (Armour et al., 2016; Arnberg et al., 2014; Creamer et al., 2003). This is in line with literature reviews reporting that PTSD is better characterised using a four-factor, or a five-factor structure instead of the three factors proposed by the DSM-IV (Armour et al., 2016; Elhai & Palmieri, 2011).

King et al. (2009) found that a four-factor solution represented data best. The four subscales that they confirmed were intrusion, avoidance-numbing, hyperarousal, and sleep issues. In contrast, Arnberg et al. (2014) found that a five-factor structure provided the best fit in a sample of natural disaster survivors in Sweden. The five factors that they identified were intrusion, avoidance, numbing, dysphoric arousal, and anxious arousal. Even though these studies show that a four-factor or a five-factor model should be preferred over either the total score or the three subscales, only one application of these models exists beyond King et al. (2009), and Arnberg et al. (2014) papers. Precisely, Wang et al. (2011) replicated the four-factor model reported by King et al. (2009) in a sample of Chinese earthquake victims.

The applied literature tends to focus on the total score of the IES-R (Boals et al., 2015; Ehring & Quack, 2010; Johannesson et al., 2015; Ludäscher et al., 2015; Meeske et al., 2013; Mithoefer et al., 2013; Sveen et al., 2016; Turunen et al., 2014), or the three subscales (Kazak et al., 2004; Rash et al., 2008; Turunen et al., 2014). Thus, this study examines the IES-R and the three subscales' total score to increase the potential generalizability of the finding to other studies.

The three subscales of the IES-R are also associated with PTSD. For instance, symptoms of PTSD are manifested in three significant ways. First, people experience intrusive thoughts about the event in terms of nightmares, reliving it repeatedly when triggered by reminders. Also, they have constant unwanted memories about their specific traumatic experience. One way to distinguish between intrusive memories and general memories is the degree of vividness and memory specificity. Traumatic memories tend to be emotion-laden and include sensory experiences of unique sights, sounds, or sensations (Brewin, 2001). If individuals recall the incident in great detail but cannot remember what actions they took or their role, this is more likely to be a traumatic memory. Also, if they recall the event as feeling like they were in a dream or that things were moving in slow motion or excessively fast, these are also indicators of a posttraumatic response. Brewin (2001) informed us that reliving a traumatic event does not occur due to a deliberate search of memory but is always triggered involuntarily by internal or external cues.

Another manifestation of PTSD is symptoms of avoidance and emotional numbing. Suppose the Preston-New-Road fracking site residents state that they cannot read accounts, watch news broadcasts of the devastation, or even talk about it because this causes them to re-experience the event. In that case, this is likely to be symptomatic of PTSD. Emotional numbing is an expression of a ‘feelingless’ state. Some individuals may say that they feel numb when they discuss their experience. Denial and emotional numbing are qualitatively

different responses because in the latter case, people admit that the event occurred, but they feel nothing about it. In this case, denial has to do with the feelings about the event, but a diminished capacity to think it is not the same as asserting that it did not affect the individual. Denial differs from emotional numbing in that people do not claim that they are functioning at the same level as they did before the traumatic experience in the latter case.

The third common expression of PTSD is hyperarousal or an unusually high level of alertness. These individuals tend to be hypervigilant. Recognizing hyperarousal or hypervigilance related to PTSD is difficult among ethnic minorities and other marginalized groups. They may have a predisposition to such a response because of experiences of poverty, discrimination, and exploitation (Whaley & Davis, 2007). Perilla et al. (2002) found, in their study of survivors of Hurricane Andrew, that 81% of African Americans displayed hyperarousal symptoms compared to 67% of Latinos and 63% of White respondents. Hyperarousal symptoms may be confounded with hypervigilance associated with a 'healthy cultural paranoia' due to racism and discrimination (Alim et al., 2006; Perilla et al., 2002; Pole et al., 2008). Russell Jones stated that trust issues arose in his many conversations with African-American survivors of Hurricane Katrina during his visits to the Gulf Coast (Jones et al., 2008).

Interestingly, Najarian et al. (2001) found hyperarousal to be more common among Armenian earthquake survivors than a comparison group, and they also found that survivors who remained in the affected area reported higher levels of paranoid symptoms that they attributed to distrust of the government for failure to provide adequate assistance. Hyperarousal associated with PTSD is more likely to be an exaggerated response. Other indicators are constant expressions of anger; physical aggression (i.e., fighting), particularly among youth; sleeplessness; and general irritability.

These behaviours should be given particular attention if the individuals admit that they did not engage in them before this experience. Adults also tend to increase their use of alcohol and drugs to self-medicate the symptoms. Substance abuse occurs in individuals with clinical depression as well. It is essential to assess individuals' expectancies from substance use.

If the goal is to self-medicate for depression, the individual will expect to feel euphoric or 'happier'. If hyperarousal is the reason, then the individual wants to feel more relaxed or calm down. Reactions to actual and perceived injustices or threats to personal safety and well-being are likely to be volatile.

4.3 PART TWO

4.3.1 Empirical Literature Review of IES

The evidence suggests that IES has adequate properties of reliability and validity (Joseph, 2000). However, its lack of clear criteria and norms for diagnostic use has been noted as a shortcoming of the IES. Paradoxically, it is also probably one reason for the popularity and longevity of the IES. While diagnostic criteria have changed, and new instruments have been introduced to replace those which have been made redundant, the IES has provided an unchanging standard measure of posttraumatic stress for almost twenty years (Sundin & Horowitz, 2003).

It has commonly been used to validate new measures and has provided, at least historically, what might be described as the gold standard self-report measure in trauma research. A compelling argument in favour of the continued use of the IES is that the IES allows for comparative conclusions to be made regarding similarities and differences between new and old trauma samples. Research on traumatic stress reactions after many

traumatic events has frequently used the IES (Horowitz et al., 1979). One explanation of the wide use and recognition of the IES is that it provides researchers and clinicians with a short and simple measure for detecting people with more severe posttraumatic reactions who may require treatment.

Another appealing feature is its firm theoretical basis. The categories of the conceptual hub of the measure, intrusive and avoidant experiences, are related to information processing theories about how people master dire life events (Brewin et al., 1996; Bryant & Harvey, 1996). Many major traumatizing events, such as bereavement**,** war exposure, rape, assault, and motor vehicle accidents, have been studied thoroughly in many different countries. This section, therefore, reviews the usage of the IES in the empirical literature. The IES has been used in numerous studies with a variety of adult populations. Green et al. (1994) studied race differences in response to combat stress. Their research focused on the black experiences in the Vietnam War. They used the IES to study race differences in pre-service, stressor, and outcome variables in a community sample of 181 war veterans. They found that Black veterans reported higher levels of stressors than white veterans, particularly for PTSD related symptoms.

The cognitive coping mode of avoidance did not conform to this pattern and showed higher levels for Blacks than white, even controlling for other factors (Green et al., 1994). IES has also been used to investigate stress experienced by victims of assault (Elliott & Briere, 1995). Research conducted in this field documents a relatively robust association between self-reported childhood sexual abuse and adult psychological dysfunction. The long term correlation of such victimization are symptoms of PTSD such as nightmare (flashbacks, and sleep disturbance), an altercation in mood (depression, anxiety, and anger), impaired self-functions (identity, boundary), sexual difficulties, and relationships problems (Elliott & Briere, 1995).

For instance, Elliott & Briere (1995) studied the posttraumatic stress associated with delayed recall of sexual abuse. Their study investigated delayed recall of childhood sexual abuse in a stratified random sample measured by the IES. They found that of participants who reported a history of sexual abuse, 42% described some period when they had less memory of the abuse than they did at the time of their data collection. No demographic differences were found between subjects with continuous recall and those who reported delayed recall. However, the delayed recall was associated with the use of threats at the time of the abuse. Subjects who had recently recalled aspects of their abuse reported significantly high levels of posttraumatic symptoms and self-difficulties.

Furthermore, the IES was used to assess posttraumatic stress among survivors of motor vehicle accidents. Bryant & Harvey (1996) studied the initial posttraumatic stress responses following motor vehicle accidents in 114 motor vehicle accidents victims within two weeks of hospital admission. Using the IES, they found that one-third of patients reported high levels of posttraumatic stress and anxiety. And that intrusion symptom was best predicted by fear of motor vehicle accident and the absence of head injury. Avoidance symptoms were best predicted by fear of the accident and recent stressful events. Their findings indicated that intrusion and avoidance responses to trauma are remediated by different patterns of injury-related and response-related factors.

Guest et al. (2018) also investigated psychological distress following a motor vehicle crash. Their study was a preliminary result of a randomised controlled trial investigating brief psychological intervention. The trial aimed to determine the efficacy, feasibility, and acceptability of email-delivered psychological interventions with telephone support for adults injured in a motor vehicle crash engaged in seeking compensation. This preliminary analysis's primary intention was to investigate those psychologically distressed and stop the trial midway to evaluate whether the safety endpoints were necessary.

They used the IES-R to assess psychological distress on 90 adult participants randomised into three groups, those diagnosed with depression at the Cognitive Behaviour Therapy (CBT) group, those at the healthy lifestyle group, and those in the controlled group. They found that those diagnosed with depression at the CBT group reduced psychological distress by approximately 16%. For those with depression in the healthy lifestyle group, distress increased marginally, and for those with depression in the controlled group, distress decreased by 1.2%.

Dalgleish et al. (1996) used the IES to study posttraumatic stress among survivors of disasters at sea. They studied the crisis support following the herald of free-enterprise disaster. Their study assessed the Herald of Free Enterprise ferry sinking survivors at 3- and 6-years post-disaster. They found that reported levels of support from family and friends decreased over the first three years after the event but increased over the subsequent three years.

Also, a higher retrospective rating of crisis support received in the immediate aftermath of the disaster predicted lower levels of posttraumatic symptomatology[19] as assessed by the IES, the Beck Depression Inventory, and the State-Trait Anxiety Inventory. Their findings replicated the Jupiter Cruise ship disaster and are thought to have implications for assessing and treating survivors at high risk of disturbance. The IES has also been used to assess posttraumatic stress among survivors of natural disasters. For instance, Johnsen et al. (1997) studied posttraumatic stress symptoms in non-exposed, victims, and spontaneous rescuers after an avalanche. One of the most common natural disasters in Scandinavia and Central Europe is avalanche (Norris, 1992).

[19] The branch of medicine concerned with the study and classification of the symptoms of disease

In addition to physical injuries after an avalanche, psychological reactions are also observed. In 1985, a platoon of engineers was hit by an avalanche during a defence Nuclear Accident Response Organisation (NARO) exercise resulting in 16 dead and 15 injured soldiers. Baxendale (1996) reported that survivors of this avalanche showed symptoms associated with posttraumatic stress disorders.

Because of the NARO accident, Johnson et al. (1997) used the IES to investigate a company from the Norwegian army two weeks and four months after an avalanche hit them during a winter exercise. The subjects were divided into victims, spontaneous rescuers, and non-exposed subjects. The results showed that exposed subjects, i.e., victims and rescuers, reported higher levels of symptoms than non-exposed subjects. They also observed that no differences were found among exposed subjects. And the level of symptoms was more elevated than comparable previous research both on victims and professional rescuers or non-professionals assigned a role as rescuers. All groups showed a decrement in symptoms on the four months follow up.

Picou et al. (1992) studied the disruption and stress in an Alaskan Fishing Community: Initial and Continuing Impacts of the Exxon Valdez Oil Spill. Their research employed an ecological-symbolic theoretical approach that identifies natural resource communities as vulnerable to the disaster that contaminates biophysical resources. Their study identifies a continuing pattern of stress and disruption eighteen months following the Exxon Valdez oil spill. Their research's premise is that various long-term mental health and community disruption problems characterise victims of technological disasters (Freudenburg & Jones, 1991; Gill & Picou, 1991).

Based on this premise, their work was on the initial five months and continuing eighteen months pattern of community disruption and stress resulting from the Valdez oil spill

(Picou et al., 1992). In their work, the second phase of their analysis involved analysing the IES items and comparing stress levels between impact and controlled communities. Their results indicated that intrusive stress and avoidance behaviour scales were identifiable outcomes of the Valdez oil spill five months following the spill and continuing eighteen months (Picou et al., 1992).

Gill et al. (2014) similarly used the IES to compare the Exxon and BP oil spill's psychosocial stress. Their research answered whether the 2010 BP Deepwater Horizon oil spill had a similar psychosocial impact as the 1989 Exxon Valdez oil spill. They evaluated five sets of predictors; indicators of vulnerability, resource loss, risk perception, and recreancy, and demographic variables on three dependent variables; the IES, Intrusion subscale, and Avoidance subscale. Their findings indicated that the vulnerability variables had a positive effect on all three dependent variables. Concerns over resources were necessary as the economic future was positively significant ($p>0.001$).

However, economic loss was consequential only in the IES and intrusion subscales. Air quality concern and oil harvest areas were significant across all three dependent variables, while family health was positive and significant only in the IES and Intrusion subscales. The demographic variables had minimal impact on psychological stress levels except that people who lived in the community longer and were not married reported more significant numbers of intrusive symptoms.

Finally, according to all of the models, south Mobile County residents were significantly more stressed than were residents of Baldwin County. The adjusted R^2 values demonstrate that the models fit well as 47 % of the IES variance, 47 % of the variance in Intrusion and 36 % of the variance in Avoidance were explained by combined predictors (Gill et al., 2014b). Morina et al. (2013) conducted a study to examine the IES-R's diagnostic utility as

a screening tool for post-traumatic stress disorder in survivors of war. Their administered IES-R questionnaires were completed by two independent samples that had survived the Balkans war[20]. The first group was a sample of randomly selected people who had stayed in former conflict (3,313 respondents) and the second group a random of refugees to Western European countries (854 respondents).

All participants reported exposure to at least one war-related potentially traumatic event (i.e., equivalent to the stressor criterion 1A of PTSD described above). The average time since the most traumatic event was 8.1 years (*SD*=3.3) among participants in the Balkan countries and 10.5 years (*SD*=3.1) among refugees. On average, refugees in the Western countries reported a significantly higher number of war-related potentially traumatic events (*M*=6.76, *SD*=3.62) than participants living in the Balkan countries (*M*=4.17, *SD*=2.79), $t(4165)=22.61$, $p<.001$; d=0.80). The most often reported war-related, potentially traumatic events among both refugees and participants in the Balkan countries were:

a. Shelling or bombardment (85.1% of refugees vs 84.6% of participants in the Balkans),

b. Lack of shelter (64.5% of refugees vs 51.4% of participants in the Balkans),

c. Siege (59.5% of refugees vs 40.1% of participants in the Balkans), and

d. Murder or death of a close person due to violence" (60.8% of refugees vs 35.9% of participants in the Balkans).

Additionally, participants in the Balkan countries reported on average, 0.7 (*SD*=1.1) and 0.6 (*SD*=0.8) pre-war and post-war potentially traumatic events, respectively. The average

[20] The Balkan Wars consisted of two conflicts that took place in the Balkan Peninsula in 1912 and 1913.

pre-war and post-war potentially traumatic events among refugees was 1.1 (*SD*=1.3) and 1.1 (*SD*=1.3), respectively.

The IES-R's internal consistency values were high, resulting in a value of α=0.97 in both groups. As compared to participants living in the Balkan countries, refugees reported significantly higher scores of the IES-R total and the subscales (all *ps.* <0.001; d=0.30). Participants with PTSD reported substantially higher IES-R total scores (both *ps* <.001; both d=1.92 for the Balkan sample and refugees. This study's findings in two independent samples suggest that the IES-R can be effectively used as a screening instrument for PTSD in a war-related event (Morina et al., 2013). They concluded that when structured clinical interviews are not feasible or absorb inappropriate resources, IES-R scores can be used reasonably to identify people with PTSD. This can apply to screening in populations and assessments in large-scale research studies. In both clinical and research settings, the IES-R has been reported to be one of the most frequently used measures (Elhai et al., 2005), and results of the current study show that a cut-off score of 34 can be used to translate the IES-R scores into an assessment of a PTSD diagnosis.

Examples could include surveys among populations that have been collectively exposed to potentially traumatic events such as armed conflicts, terrorist attacks, large-scale accidents, and natural disasters. One may conclude that existing IES-R scores can be used to screen for PTSD and underline the scale's usefulness for research and clinical purposes (Morina et al., 2013, p8). The IER has also been influential in the health care sector with its usage in various sectors. For instance, it has been used in clinical outcome work to assess the effectiveness of a drug trial. Davidson et al. (1991) studied the effect of Fluoxetine[21] in

[21] Fluoxetine is an oral prescription medication used to treat conditions such as depression, obsessive-compulsive disorder and panic attacks. https://www.medicalnewstoday.com/articles/322413.php

posttraumatic stress disorder. Fluoxetine was given to five nonveteran patients with posttraumatic stress disorder. The maximum doses ranged from 20 to 80 mg/day, and treatment was continued for between 8 and 32 weeks. In contrast to publishing reports of other drugs, which were noted to improve only the intrusive symptoms of PTSD, fluoxetine was associated with marked improvement of both intrusive and avoidance symptoms. Facilitative effects of fluoxetine were reported on trauma-focused psychotherapy in two adult victims of childhood sexual trauma. In part, these effects were related to modulating effects of the drug upon the intensity of core PTSD symptoms.

Hossack & Bentall (1996) used the IES to study the effects of relaxation training on PTSD. They studied five patients who have PTSD and experiencing persistent intrusive imagery. They treated them with two sessions of relaxation training followed by two sessions of the visual-kinesthetic dissociation technique[22]. The outcome was monitored using a multiple scale design. With the IES aid, they found that three of the patients showed an almost complete reduction in the frequency of their intrusive image and substantial changes on other measures of psychopathology. One patient showed partial improvement, and one patient showed no progress at all.

Richards et al. (1994) further used the IES in a treatment program to assess PTSD in patients experiencing trauma. In their study, the relative values of imaginal and real-life exposure exercises were tested by randomizing 14 patients who met the Diagnostic and Statistical Manual of Mental Disorders revised (DSM-III-R) criteria for PTSD at least six months after the initiating trauma to one of the two groups.

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[22] The visual-kinesthetic dissociation (V/KD) protocol is an intervention originally designed in the early 1980s for use with phobias.

Group 1 (7 patients) had four weekly, hour-long sessions of imaginal exposure followed by four weekly, hour-long sessions of live exposure. Group 2 (7 patients) had the reverse order of four love sessions followed by four imaginal exposure sessions. Both groups improved significantly on both PTSD specific measures and measures of general health post-treatment, and significantly further on 7 out of 12 measures at follow up 12 months post-treatment. Clinical improvement was in the order of 65-80% reduction in target symptoms. On one measure only, i.e., problem 2 phobic avoidance, live exposure yielded more improvement than imaginal exposure to all relevant cues, behavioural and cognitive, is discussed together with the value of self-exposure homework for patients with PTSD.

Ford et al. (1997) studied the effects of posttraumatic stress in and after Operation Desert Storm (ODS) among military persons deployed in Saudi Arabia, Kuwait, or Iraq. These veterans encountered war-zone trauma, and in the first year of ODS, it is recorded that 10% experienced clinical-level psychosocial impairments (Perconte et al., 1993; Sutker et al., 1994). They conducted a time-limited psychotherapy 2 to 9 months after demobilization was evaluated with Persian Gulf Theatre veterans of the ODS. Thirty-five treatment-seeking veterans were contrasted with 20 non-treatment-seeking ODS Persian Gulf veterans in a repeated measures design at pre-test, post-test, and six-week follow-up assessments.

Also, psychotherapy participants at follow-up were contrasted with 80 non-treatment-seeking ODS Persian Gulf veterans from the same military units who were assessed one time at a comparable time point. They found that time-limited psychotherapy was associated with sustained improved psychosocial functioning and reduced psychiatric and stress-related symptomatology levels. Grainger et al. (1997) test the Eye Movement Desensitization and Reprocessing (EMDR) effectiveness in treating trauma-related reactions following Hurricane Andrew. Hurricane Andrew ravaged South Florida in

August 1992. It caused about 50 deaths, 28,000 destroyed, and 107,000 damaged homes, 86,000 jobless people, 82,000 destroyed businesses, 160,000 homeless, and 5,000 injured and sick people. As is expected of a disaster of this magnitude, posttraumatic stress reactions set in. According to Grainger et al. (1997), EMDR has been empirically shown to modify PTSD symptoms.

Therefore, this study was conducted to examine its usefulness in treating natural disaster survivors in the natural environment under conditions of chaos, time, and facilities limitations and with people in a perplexed and traumatized state. They produced a positive result in that EMDR had significant improvement over wail list controls in perceived post-traumatic avoidance behaviours and thoughts as measured by changes in the IES and considerable improvement in subjective aversive reactions to the hurricane's representative experience. They, therefore, concluded that EMDR could be an effective therapeutic intervention for trauma reactions.

The IES has also been used to study PTSD in children and adolescents. For instance, Green et al. (1994) conducted a long term follow up of child survivors of a devastating human-caused disaster. They evaluated child survivors between 2 – 15 years of the Buffalo Creek dam collapse[23], first evaluated in 1974 (two years post-disaster) and revaluated after 17 years when they were adults. They found that psychiatric symptoms at the two points in time showed a significant decrease in overall severity ratings and anxiety, aggressiveness, somatic concerns, and agitation. A few symptoms, not present in the child sample, increase over time (substance abuse, suicidal ideation).

23 The Buffalo Creek flood was a disaster that occurred on February 26, 1972, when the Pittston Coal Company's coal slurry impoundment dam #3, located on a hillside in Logan County, West Virginia, burst, four days after having been declared "satisfactory" by a federal mine inspector.

The current rate of disaster-related PTSD was 7%, down from a post-flood rate of 32%. There were no differences by age group in the current psychological status. However, women evidenced more PTSD related symptoms than men. McNally (1996) also assessed posttraumatic stress disorder in children and adolescent and described the IES as probably the best questionnaire available for evaluating childhood PTSD. He stated that "questionnaires based on DSM criteria can be an effective and efficient means for screening large numbers of children known to have experienced a traumatic event" (McNally, 1996, p157).

From the empirical literature analysis above, the IES and IES-R have been used extensively to study PTSD in a variety of adult populations, victims of assaults, survivors of motor vehicle accidents, survivors of disaster accidents at sea, and survivors of natural disasters. It has also been used on children and adolescents and has been described as probably the best questionnaire to assess PTSD in children (McNally, 1996).

4.3.2 Answer to Research Question One:

An emerging set of the literature suggests that shale gas development by fracking techniques might have a negative impact on the mental health of residents living near extraction sites (Casey et al., 2018; Drummond & Grubert, 2017; Perry, 2012b). Recent studies in the US suggest that residing near active fracking wells can lead to poor mental health outcomes (Casey et al., 2018; Hirsch et al., 2018; Mayer et al., 2020). In the UK, community stress in shale gas communities, even at the exploratory stage, has been raised as a significant concern (Pines, 1994). Few studies explicitly examine stress associated with shale gas development outside of the US; thus, the state of knowledge is primarily based on the US scholarship. As a result, there is a gap in the literature surrounding this issue and a need to study stress resulting from this extraction form. This section justifies

applying the literature on stress to hydraulic fracturing as an extreme event in the Preston-New-Road community. In this section, I draw upon parts 1 and 2 of this chapter to argue that the IES can inform the issue of hydraulic fracturing in the Preston-New-Road community.

4.4 Chapter Summary

This chapter examined the theory of stress. It started by looking at the relationship between the environment and psychosocial stress, including limited reports that shale gas production increases stress among the community. Then the difference between types of stress was examined. The origin, relevance, and validity of the IES and IES-R as an instrument for measuring stress were also discussed.

The chapter ended with an empirical literature review and the importance of the study of stress. This chapter answered research question 1. Research questions 2 and 3 are empirical and would be answered in chapters 6 and 7, respectively. The next chapter is the methodology and data chapter.

5.0 CHAPTER FIVE: DATA AND METHODS

5.1 Introduction

This chapter discusses the research strategy and methodological procedures used for addressing the two quantitative research questions (Questions 2 and 3) outlined in Chapter 1. Section 5.2 presents the survey's research approach. Section 5.3 discusses the sampling techniques and reason for choosing the Preston-New-Road hydraulic fracturing site for data collection. Section 5.4 outlines the essential demographic characteristics of the Westby Warton wards. The Preston-New-Road hydraulic fracturing operated by Cuadrilla Mining Resources is located in this ward.

Section 5.5 outlines a familiarization tour I made to communities in the Preston-New-Road site. Section 5.6 outlines the data collection approach, and section 5.7 briefly discusses the method for data analysis. Section 5.8 discusses the challenges I faced during the data collection phase, and section 5.8 outlines the research ethics. Section 5.9 concludes this chapter.

5.2 Survey Research

Survey research is defined as "the collection of information from a sample of individual through their responses to questions" (Check & Schutt, 2012, p. 160). This type of research allows for various methods to recruit participants, collect data, and utilize multiple instrumentation methods. Surveys are often used to explore and describe people's beliefs and human behaviour. It is, therefore used in social and psychological science (Singleton et al., 1988). The survey research is, therefore, appropriate to explore the psychosocial impact of hydraulic fracturing. This research adopted a survey because of the following reasons:

- A survey is useful in measuring a wide variety of unobservable data such as people's preferences (e.g., political orientation), traits (self-esteem), attitudes, beliefs, behaviour, or necessary information such as income.
- A survey is appropriate for remotely collecting data about a population that is too large to observe directly. A large area such as an entire community, region, or country, can be covered.
- The anonymity of surveys allows people to feel more candid with their responses. The survey provides useful, quality data as respondents provide more honest answers than other research methodology types, especially if it is clear that the answers will remain confidential.
- Survey research is also economical in terms of the researcher's time, effort, and cost than most other experimental research and case research methods (Bhattacherjee, 2012b).

The survey for this research was divided into four sections. Section I asked about the potential impact of shale gas activities in the communities. This section was made up of a list of twenty questions, and respondents were to choose whether shale gas activities increased or decreased for some actions such as noise, traffic, affordability of housing, quality of life etc.

Section II is about relationships in the community. Fourteen of the questions (sections 2.1 – 2.13) talked about the relationship between the respondents and their family, friends, and neighbourhood. Ten questions (sections 2.14 – 2.23) talked about the relationship between the respondents and other community members. Section 2.24 has six questions, and it asked respondents to rate their agreement on a Likert scale about helping others and trust in the community. Section 2.25 was made up of a list of seven questions on a six scale

Likert scale. It asked about respondents' connection (trust) with decision-makers, and the gas company (Cuadrilla Mining Resources). Sections 2.26 – 2.29 asked respondents to answer questions about the sense of community in their community. Sections 2.30 asked respondents about diversity in their community, and section 2.31 asked respondents to rate their overall acceptance or otherwise of shale gas extraction in their community. Sections 2.32 – 2.37 asked respondents about their social relations and participation in voluntary activities concerning hydraulic fracturing.

Section III is the revised-Impact of Event Scale. The IES-R is an easy-to-administer questionnaire used to evaluate the degree of distress in response to trauma. It asked respondents to rate how much they have been stressed by a series of events in the past week. The IES-R is made up of a list of short 22-questions from the previous 15 questions. It also has a scoring rate of between 0 – 88. Section IV asked respondents about themselves and their backgrounds. They were asked questions such as their age bracket, income, employment status, income, etc.

5.3 Sampling

There are various types of sampling techniques in survey research. I used purposive sampling. Purpose sampling is a non-probability sampling method, and it occurs when elements selected for the sample are chosen by the researcher's judgment. Researchers often believe that they can obtain a representative sample by using a sound judgement, which will result in saving time and energy (Black, 2009). As a result, the statistically significant tests used to analyse relationships between variables are employed mainly to choose between the best statistical model rather than inference about relationships in the population. The purposive sampling technique was used to select the sample area. However, the census sampling technique was used in the administration of the survey

questionnaire. A census is a study of every unit, everyone, or everything, in a population. It is also known as complete enumeration, which means an absolute count (Lavrakas, 2008b). It attempts to list all elements in a group and measure one or more characteristics of those elements. The group is often an actual national population, but it can also be all houses, businesses etc. A census can provide detailed information on all or most population elements, thereby enabling totals for rare population groups or small geographic areas (Lavrakas, 2008b).

The significant advantage of census sampling is that it increases confidence in the results by including everyone in the sample. Conducting a census often aids in producing a representative sample, mainly if the population the researcher is studying contains only a few thousand individuals. While census sampling may be more expensive and time-consuming, however, given the remote nature of my sample area and the security issues around fracking, it was appropriate to use this technique.

This research population of interest is all residents living within 100 miles of the hydraulic fracturing site at Preston-New-Road operated by Cuadrilla Mining Resources. Pless-Mulloli et al. (2000) found a positive correlation between proximity to mining sites and mental health. They found that psychosocial stress is higher in residents living near mining sites. They describe the loss of local landscape as having the potential to be “traumatic and intense an emotion as bereavement” (Pless-Mulloli et al., 2000, p148)). Therefore, this research is also targeted at a community near the hydraulic fracturing site operated by Cuadrilla Mining Resources in Lancashire, England.

This research target population is residents living around the Preston-New-Road hydraulic fracturing sites operated by Cuadrilla Mining Resources. The Preston-New-Road site is in Preston, Lancashire. It is in Poulton-le-Fylde in the Warton and Westby ward. This

information was provided by the electoral service manager of the Flyde Borough Council in Lancashire via email communication. The Westby ward has 870 registered properties, and 653 properties are currently occupied (Electoral Service Manager of Flyde Borough Council, September 21, 2017). The next immediate village is Wrea Green, and this has 483 properties currently occupied (Electoral Service Manager of Flyde Borough Council, September 21, 2017).

My supervisory team and I agreed to use all the villages in the Warton wards as the sample population. The Electoral Service Office of Flyde Borough Council provided the street addresses of these wards. The total targeted household was, therefore, 1,136. Postal packages were posted to every home in five different batches. One hundred ninety-eight respondents responded to the questionnaire, representing just over 17% response rate. The communities that are within these wards and near the fracking site are; (1) Great Plumpton, (2) Little Plumpton, (3) Blackpool, (4) Kirkham and (5) Wesham.

As earlier discussed in chapter two. Lancashire is the first and currently the only county in England where full-scale exploratory hydraulic fracturing happened. This makes Lancashire an appropriate site for the study of psychosocial stress in England. The next section will discuss the basic demographics of the wards surrounding the Preston-New-Road fracking site.

5.4 Basic Demographics of the Warton Westby ward

The tables below show more comprehensive numbers and demographic characteristics of the communities around Preston-New-Road site. The tables give a sense of the site's demographics. These tables are from the Office of National Statistics. They provide details on the population's age and the number of people actively involved in employment and

those unemployed or inactive. It also details the employment type and occupation type of the people surrounding the Preston-New-Road site.

Population aged 16-64 (2013)

	Warton And Westby (Numbers)	Fylde (Numbers)	England And Wales (Numbers)
All persons	3,076	45,574	36,973,396
Males	1,525	22,897	18,470,170
Females	1,551	22,677	18,503,226

Source: ONS mid-year population estimates

Note: Percentages are based on total population.

Table 5.1: Basic demographics of the Warton Westby ward

Employment and unemployment (2011)

	Warton And Westby (Numbers)	Warton And Westby (%)	Fylde (%)	England And Wales (%)
All People				
Economically Active	2,219	78.4	77.3	76.8
In Employment	2,107	74.5	73.1	71.0
Employees	1,751	61.9	61.5	60.6
Self Employed	356	12.6	11.6	10.4
Unemployed	112	5.0	5.5	7.6
Males				
Economically Active	1,175	84.3	80.8	82.0
In Employment	1,115	80.0	75.8	75.1
Employees	865	62.1	59.9	60.5

Table 5.2: Employment and Unemployment

Employment and unemployment (2011)

	Warton And Westby (Numbers)	Warton And Westby (%)	Fylde (%)	England And Wales (%)
Self Employed	250	17.9	15.8	14.7
Unemployed	60	5.1	6.2	8.4
Females				
Economically Active	1,044	72.8	73.8	71.7
In Employment	992	69.1	70.4	66.9
Employees	886	61.7	63.0	60.7
Self Employed	106	7.4	7.4	6.2
Unemployed	52	5.0	4.6	6.8

Source: 2011 Census (Table DC6107EW - Economic Activity by sex by age)

Note: Percentages are based on population aged 16-64, except unemployed which is based on economically active

Table 5.2 (conti.) Employment and

Employment and unemployment (2011)

	Warton And Westby (Numbers)	Warton And Westby (%)	Fylde (%)	England And Wales (%)
	Warton And Westby (Numbers)	**Warton And Westby (%)**	**Fylde (%)**	**England And Wales (%)**
All People				
Economically Inactive	610	21.6	22.7	23.2
Retired	243	8.6	8.1	4.9
Student	102	3.6	3.9	6.6
Looking After Home Or Family	133	4.7	3.7	4.9
Long-Term Sick Or Disabled	94	3.3	4.6	4.6
Other	38	1.3	2.4	2.3

Table 5.2 (conti.). Employment and Unemployment

Employment and unemployment (2011)				
	Warton And Westby (Numbers)	Warton And Westby (%)	Fylde (%)	England And Wales (%)
Males				
Economically Inactive	219	15.7	19.2	18.0
Retired	86	6.2	6.2	3.5
Student	55	3.9	4.1	6.7
Looking After Home Or Family	9	0.6	0.8	0.9
Long-Term Sick Or Disabled	50	3.6	4.9	4.8
Other	19	1.4	3.2	2.1
Females				
Economically Inactive	391	27.2	26.2	28.3
Table 5.2 (conti.) Employment and Unemployment			10.0	6.3

Employment and unemployment (2011)

	Warton And Westby (Numbers)	Warton And Westby (%)	Fylde (%)	England And Wales (%)
Student	47	3.3	3.7	6.4
Looking After Home Or Family	124	8.6	6.5	8.8
Long-Term Sick Or Disabled	44	3.1	4.2	4.3
Other	19	1.3	1.7	2.5

Source: 2011 Census (Table DC6107EW - Economic Activity by sex by age)

Note: Percentages are based on population aged 16-64.

Table 5.2 (conti.). Employment and Unemployment

Employment by occupation (2011)

	Warton And Westby (Numbers)	Warton And Westby (%)	Fylde (%)	England And Wales (%)
1 Managers and Senior Officials	296	13.2	12.7	10.8
2 Professional	383	17.1	20.7	17.4
3 Associate Professional & Technical	271	12.1	12.5	12.7
4 Administrative & Secretarial	264	11.8	12.5	11.4
5 Skilled Trades	254	11.4	10.4	11.5
6 Personal Services	189	8.5	9.5	9.4
7 Sales and Customer Services	169	7.6	7.1	8.4
8 Process Plant and Machine Operatives	152	6.8	5.3	7.2
9 Elementary Occupations	257	11.5	9.3	11.2

Table 5.3: Employment by occupation

Note: Figures are for persons aged 16 and over by Soc 2010 major groups. Percentages are based on all persons in employment.

Qualifications (2011)

	Warton And Westby (Numbers)	Warton And Westby (%)	Fylde (%)	England And Wales (%)
All People				
Level 4 Qualifications and Above	803	28.4	33.2	29.7
Level 3 Qualifications	414	14.6	15.3	14.5
Level 2 Qualifications	592	20.9	19.1	17.2
Level 1 Qualifications	441	15.6	14.1	15.2
Apprenticeships and Other Qualifications	193	6.8	6.6	8.6
No Qualifications	386	13.6	11.8	15.0

Table 5.4: Categorization of qualifications

Qualifications

Level 4 qualifications and above: Degree (for example BA, BSc), Higher Degree (for example MA, PhD, PGCE), NVQ Level 4-5, HNC, HND, RSA Higher Diploma, BTEC Higher level, Foundation degree (NI), Professional qualifications (for example teaching, nursing, accountancy)

Level 3 qualifications: 2+ A Levels/VCEs, 4+ AS Levels, Higher School Certificate, Progression/Advanced Diploma, Welsh Baccalaureate Advanced Diploma, NVQ Level 3; Advanced GNVQ, City and Guilds Advanced Craft, ONC, OND, BTEC National, RSA Advanced Diploma

Level 2 qualifications: 5+ O Level (Passes)/CSEs (Grade 1)/GCSEs (Grades A*-C), School Certificate, 1 A Level/ 2-3 AS Levels/VCEs, Intermediate/Higher Diploma, Welsh Baccalaureate Intermediate Diploma, NVQ level 2, Intermediate GNVQ, City and Guilds Craft, BTEC First/General Diploma, RSA Diploma

Level 1 qualifications: 1-4 O Levels/CSE/GCSEs (any grades), Entry Level, Foundation Diploma, NVQ Level 1, Foundation GNVQ, Basic/Essential Skills

Apprenticeships and other qualifications: Apprenticeship, Vocational/Work-related Qualifications, Foreign Qualifications (not stated/level unknown)

No qualifications: No formal qualifications held

5.5 Summarized Demographic Statistics from Data

The tables below is a graphical representation of my data. This demonstrates how my data is representative of the larger area. I summarized the gender variable, education variable, employment variable, age variable, income variable, political orientation variable, and race variables. These summarized variables are important because they provide a feel of the sampled population and help grasp the meaning of the more extensive data's content.

Sex Variable

Sex	**Freq.**	**Percentage**	**Cum.**
Female	73	40.33	40.33
Male	108	59.67	100
Total	181	100.00	

Table 5.5 Summary statistics of sex from survey data

Table 5.5 above shows that the number of males is 108, and the number of females is 73. Thus, more males responded to the survey questionnaire than females. Females were scored “1” and males scored “0”. The total number of respondents who answered the question on sex is 181. The mean score is 0.40, the standard deviation is 0.49, and the minimum and maximum values are 0 and 1, respectively.

Education Variable

Education	Freq.	Percentage	Cum.
No education	17	9.50	9.50
GCSE	18	10.06	19.55
Apprenticeship/A/AS level	51	28.49	48.04
Higher-level	93	51.96	100.00
Total	179	100.00	

Table 5.6: Summary statistics of education from survey data

Table 5.6 above shows that the total number of respondents for the education variable level is 179. Just about 9.5% of the respondents have no education, and about 52% have higher education levels.

Employment Variable

Employment	Freq.	Percentage	Cum.
Unemployed	91	49.91	49.91
Employed	94	50.81	100.00
Total	185	100.00	

Table 5.7: Summary statistics of employment from survey data

From Table 5.7 above, the total number of respondents for the employment variable is 185. The number of employed respondents is 94, and the number of unemployed residents is 91. Those employed were given sore of "1" while those unemployed were given score of "0". The mean score is 0.51, the standard deviation is 0.50, and the minimum and maximum values are 0 and 1, respectively.

Age Variable

Age	**Freq.**	**Percentage**	**Cum.**
18 – 24	1	0.55	0.55
25 – 34	8	4.42	4.97
35 – 44	14	7.73	12.71
45 – 54	35	19.34	32.04
55 – 64	47	25.97	58.01
65 – 74	53	29.28	87.29
75 – above	23	12.71	100.00
Total	181	100.00	

5.8Summary statistics of age from survey data

From Table 5.8 above, the total number of respondents of the age variable is 181. The number of respondents who are aged 55 years and above is approximately 68%. This shows that the population of the community is quite old, and most are retired.

Income Variable

Income	Freq.	Percentage	Cum.
Up to £599	37	26.81	26.81
£600 - £1249	34	24.64	51.45
£1250 - £1999	31	22.46	73.91
£2000 - £2999	20	14.49	88.41
£3000 - £3999	5	3.62	92.03
£4000 – above	11	7.97	100.00
Total	138	100.00	

Table5.9: Summary statistics of income variable from survey data

From Table 5.9 above, the total number of respondents for the income variable is 138. The mean income is between £600 and £1,249.

Political Orientation Variable

Political Orientation	Freq.	Percentage	Cum.
Labour	69	44.23	44.23
Conservative	87	55.77	100.00
Total	156	100.00	

Table 5.10: Summary statistics of Political Orientation variable from survey data

From Table 5.10 above, the total number of respondents for the political orientation variable is 156.

Race Variable

Race	Freq.	Percentage	Cum.
Ethnic minority	1	0.56	0.56
Native British/White	179	99.44	100.00
Total	180	100.00	

Table 5.11: Summary statistics of Race variable from survey data

Table 5.11 above shows that the number of respondents of the race variable is 180 respondents.

5.6 Familiarization Tour to Proposed Drilling Sites in Lancashire

On 18th January 2017, my colleague and I undertook a familiarization tour to the proposed Lancashire drilling sites. The tour of the Fylde was very significant and necessary. It allowed me to have first-hand information on activities around the hydraulic fracturing sites. An important observation is the rural and sparse settlement of the Fylde due to its rural nature. It was initially agreed I do door-to-door hand-delivery of my survey question. This, however, is practically impossible considering the sparse settlement of the community.

Secondly, I realized the community is politically charged with posters and signpost on buildings, trees, etc. This raised security concern of the researcher should hand-delivering of surveys be chosen. Hence the agreement to adopt mail-delivery as a data collection approach. The Ethics Committee of Northumbria University eventually approved this approach. This tour enabled me to choose the neighbourhood I would ultimately survey. I

also had the opportunity to discuss with some of the local residents to find out how they feel about fracking in their neighbourhood. Below is a short description of my trip.

My colleague and I left Newcastle central train station at precisely 6:45 am to Poulton-le-Fylde in Lancashire. Our journey started from Newcastle Upon Tyne to Carlisle. At Carlisle we boarded a train to Preston and finally from Preston to Poulton-le-Fylde. When we arrived at Poulton-le-Fylde, we met a taxi driver who was helpful to us during our visit. He drove us around and also acted as the lead person to the communities. He briefed us on current happening in the area concerning shale gas drilling. He told us of his friend who is very worried by the community's planned drilling activity. His friend owns a pool, and he charges £5 a day per residents who want to fish. The taxi driver's friend is worried because he has no idea what effect hydraulic fracturing will have on his fishing business. Any adverse effect will take away his livelihood from him. The level of uncertainty narrated above has the likelihood of developing into stress. The stress literature confirms this statement. Cuadrilla has three sites in Preston that have been earmark for drilling. These are **Weeton Preston hall farm**, **Roseacre road west site** and **Preston-new-road site.** I examined each of these sites below.

Weeton Preston Hall Farm

Weeton Preston Hall Farm is the first site we visited, and as the name suggests, it is a farming area. The place that has been earmark for drilling is behind Weeton Barracks which is home to the 2nd battalion Duke of Lancaster's Regiment. The site has been cordoned but at the main entrance to the site is Weeton Children Center and Weeton Primary School. There are houses in the vicinity; notable among them is the Primrose Bank Holiday Park which has lots of houses built for residents. Below are pictures from the Weeton Preston hall farm sit:

Figure 5.1: Picture of Weeton Preston Hall Farm site (located behind this barracks)

Figure 5.2: Weeton Preston Farm site: adjacent the barracks.

Figure 5.3: Road in front of the barracks and the community schools

Figure 5.4: Primrose bank holiday homes. This is located about 200cm to the barracks

Figure 5.5: Entrance to Primrose Holiday Homes

Figure 5.6: Inside of Primose Holiday Homes

Figure 5.7: Entrance to Primrose Holiday Home

Figure 5.8: Surrounding houses at Primrose Holiday Homes

Figure 5.9: Entrance to proposed drilling site by Cuadrilla at Weeton Hall Farm

Figure 5.10: Entrance to Weeton Preston Hall Farm

Figure 5.11: The road leading to Weeton Preston Hall Farm drilling site

Roseacre-Road Drilling Site

The next site we visited was the Roseacre-Road site. This site is not new as there have been active drilling (not hydraulic fracturing) on this site since 1993. However, the well fractured so it was closed. This site's surrounding area is purely a farming area, and many residents live around the site. We noticed lots of anti-fracking posters on houses and streets.

We interviewed one resident who said the posters were posted by a team from outside the community “they only moved in for about three days, got them pasted and left”, she said. This raises the question as to whether the local residents are not interested in the anti-fracking campaign. Roseacre-Road is a farming community, and residents make a living from animal husbandry. Below are some pictures:

Figure 5.12: Picture of a farm field

Figure 5.13: Field with livestock's grazing

Figure 5.14: Enclosed farm field

Figure 5.15: Grazing livestock on an enclosed field

Figure 5.16: House at Roseacre-Road

Figure 5.17: Entrance into Roseacre-Road drilling site

Figure 5.18: Detailed entrance into Roseacre-Road community

Figure 5.19: Rosecare-Road community

Figure 5.20: Rosecare-Road community

Figure 5.21: Farmhouse looked at Rosecare-Road.

Figure 5.22: Stable at Roseacre-Road with anti-fracking poster

Figure 5.23: Surrounding house at Roseacre-Road with anti-fracking poster

Figure 5.24: My colleague posing with an anti-fracking poster at Roseacre-Road

Figure 5.25: Anti-fracking poster on display at Roseacre-Road

Preston-New-Road Drilling Site

The Preston-New-Road drilling site is the only active site of all the sites we visited. Drilling will start four months from now (This brief meeting happened on 19th January 2017. Exploratory drilling has already begun). This site is located along a busy main road with houses around the area. Blackpool city centre is approximately 3 miles from this site. Some environmental activists were protesting at the entrance of this fracking site. Below are some pictures:

Figure 5.26: Preston New Road drilling site with work on-going

Figure 5.27: Protestors protesting at the PNR site

Figure 5.28: Picture of work in progress at Preston New Road drilling site

Figure 5.29: Overview of Preston New Road drilling site

Figure 5.30: Attractive poster by the protestors.

Figure 5.31: Picture of researcher with some protesters.

5.7 Data Collection

Consistent with the survey research approach, the present research adopted the cross-section approach of data collection. A cross-sectional survey is appropriate for this research because it involves people who differ on one critical characteristic at a point in time. The data is also collected simultaneously from people who are similar in other aspects but differ in a vital factor of interest such as age, income level, geographic locations, etc.

According to Cherry (2018), a cross-sectional survey uses different groups of people who differ in the variable of interest but share other characteristics such as socioeconomic status, educational background, and ethnicity. Cross-sectional studies are observatory in nature and are known as descriptive research. This approach cannot determine the cause of a disease but can describe characteristics that exist in a community. The cross-sectional survey is used to make inferences about possible relationships or to gather preliminary data to support further research (Cherry, 2018).

This type of research is also used to determine the prevailing characteristics at a certain point in time. For instance, a cross-sectional study might be used to determine if the exposure to specific risk factors might correlate with particular outcomes. While this type of research cannot demonstrate cause-and-effect, it can provide a detailed look at the correlations that may exist at a specific time (Cherry, 2018).

Some of the advantages of the cross-sectional survey include the following:

- They are inexpensive and fast: Cross-sectional surveys are usually affordable and allow researchers to collect a great deal of information quickly. Data is often obtained using self-report surveys, and researchers can amass a large amount of information from a large pool of participants.

- They allow different variables: Researchers can collect data on some additional variables to see how differences in sex, age, educational status, and income might correlate with a critical variable of interest
- They pave the way for further studies: While cross-sectional studies cannot be used to determine causal relationships, they can provide a useful springboard to further research (Bhattacherjee, 2012b).

Some potential challenges to the cross-sectional survey are that finding specific participants may be challenging. This is because this study generally requires a large number of participants, and finding those who are very similar, except in one specific variable can be difficult. Another challenge is cohort differences. For instance, individuals born within the same period may share meaningful historical experiences. Still, people in that group born in a given geographical region may share experiences limited solely to their physical location (Bhattacherjee, 2012b).

5.7.1 Appropriateness of Cross-sectional Approach

The cross-sectional survey involves collecting information from respondents at a single period in time instead of a longitudinal study where the researcher gathers data over time or from one point in time until another. Cross-sectional is appropriate because, first, this research used the IES-R scale, a 22-item self-report and administered measure that assesses subjective stress caused by traumatic events. The IES-R asks respondents to rate how stressful events have been for them in the past seven days. The number of months or years the respondents experience stress is therefore irrelevant; hence, a cross-sectional survey is appropriate.Second, this research is also time-bound as the researcher must submit the final thesis within a specified time frame. Therefore, there is insufficient time (or resources) to run an annual longitudinal survey—though that might be desirable. The period from data

collection, to analysis, writing, and final submission is almost a year. This is woefully inadequate.

Third, there is a limited fund for long-time data collection. A cross-sectional survey is less expensive because data is collected once in a single period. The amount of money spent to post the survey questionnaire is over £1200. This amount excludes stationery and other miscellaneous costs. The department provided just about £750. The researcher and the research supervisor bore the additional fees.

5.7.2 Data collection Technique

This research used a survey questionnaire as the source of primary data. Sir Francis Galton invented the survey questionnaire. It is a research instrument consisting of questions (items) intended to capture respondents' responses in a standardised manner (Bhattacherjee, 2012b). It is one of the widely used data collection techniques in quantitative research (Bhattacherjee, 2012b; Blaxter et al., 2001). This research used predominantly structured survey questionnaires. A structured questionnaire is a quantitative method of data collection advocated by Emile Durkheims (1858-1917) where the respondents could only choose the answer from the given alternatives given by the researcher. It is a positivist research method that includes the researcher's low level of involvement and many respondents (Bryant, 2015).

Before the survey questionnaires were administered, I conducted a pilot study. In social sciences, the term pilot study is used in two different ways. It can refer to the feasibility studies which are “small scale versions, or trial runs, done in preparation for the major study” (Polit & Beck, 2010, p.467). However, a pilot study can also be the pre-testing or ‘trying-out’ of a particular research instrument (Baker, 1998). One of the advantages of conducting a pilot study is that it might give advance warning about where the primary

research project could fail, where research protocols may not be followed, or whether proposed methods or instruments are inappropriate or too complicated.

In conducting the pilot study, I engaged the services of experts and residents around Newcastle. The pre-test's purpose was to test the understanding of the survey questions and their answers' appropriateness or otherwise. This pre-test also tested the time it will take to complete the survey questionnaire. In all, a total of 30 survey questionnaires were used in the pre-test. The views of the experts and the local residents were taken into consideration. The average time it took to complete the survey questionnaire was approximately 30 minutes. This time frame was deemed appropriate by the researcher and the research team. After the necessary corrections were effected, the survey questionnaire was ready to be administered in the selected sample area.

According to Bhattacherjee, a survey questionnaire is administered in three ways; a self-administered mail survey, group-administered questionnaire, or telephone interview (Bhattacherjee, 2012b). The research team decided to use a traditional mail-in approach for the administration of the survey questions because of the following reasons. First, hydraulic fracturing has received a mixed reaction, and it elicits emotions when discussed. Second, a list of phone numbers was not available, third, residents of Preston-New-Road (PNR) community are inherently suspicious given the amount of attention and level of political protests and police presence in the area. Fouth, the traditional main-in approach adopted will ensure the researcher's safety; who would have otherwise had to go door to door in a highly politicised environment where Cuadrilla Mining Resources' presence invokes highly charged emotions (positive or negative) among many residents. Finally, the Preston-New-Road fracking site is remote and encompass a wide geographical area with isolated settlements.

Due to these factors, the research team decided that it would probably be better to administer the survey questionnaire by post. The survey questionnaires were mailed to respondents with a stamped envelope for return to the researcher. This method provides an inexpensive way of data gathering, mostly if respondents are dispersed over a large geographical area. Lancashire County Council provided the researcher with the residential addresses of the communities of interest. Each household/residential property was mailed one questionnaire. The postage package included an introductory letter, questionnaire, and a self-addressed post-paid return envelope.

5.8 Data Analysis

This study followed standard protocols for quantitative data analysis (Bhattacherjee, 2012b; Silverman, 2013; Singleton et al., 1988). These included entering survey data, preparation for data analysis, multivariate analysis, and interpretation of results (Bhattacherjee, 2012b). Standard protocols for quantitative data analysis were strictly followed. The concepts of social capital, perception of recreancy, community attachment, and the IES-R, were used to determine the initial categories or themes guiding empirical data analysis.

I coded the survey questions to allow for easy entry into my database. To prevent data loss and ensure easy accessibility, I scanned all the returned survey questionnaires and stored the hard copy in a safe place as approved by the ethics committee of Northumbria University. I asked yes, and multiple-choice questions were also asked. Scale questions that were graded on a continuum were also asked. At the end of the questionnaire, an open-ended question was asked. The respondents had the opportunity to provide other information they felt will be useful to the researcher.

Section I of the survey questionnaire examined the perceived impact of fracking. Section II of the survey questionnaire looked at the relationship and interaction among community residents before exploratory fracking started and during exploratory fracking. Section III of the survey questionnaire is the IES-R that measured the level of stress among individual in a community. Section IV of the survey questionnaire is a general question that looked at respondents' circumstances and characteristics.

All the data were thoroughly read to identify general ideas, an impression of the overall understanding, trustworthiness, and the use of information. Now the data were ready for coding. STATA[24] 13 was used for coding categorization and general management of the data. STATA is a general-purpose statistical software package used, especially in economics, sociology, political science, and epidemiology (Stata, 2019). The coding system and the conceptual frameworks were used to develop descriptions of the categories, people, events, places, or phenomena of interest. Descriptions of categories or themes were presented with narratives, tables, pictures and other graphics (Yin, 2013). Finally, the findings were interpreted in relation to the relevant literature.

5.9 Data Collection Challenges

The self-addressed stamped envelope was included in each questionnaire. The returned questionnaires were addressed directly to the lead supervisor and kept securely at a destination agreed by the Ethics Committee of Northumbria University. Each returned questionnaire was coded in excel for easy identification and data entry process. Excel data were then imported into STATA for analysis. Each role of the document represented a respondent, and each column a variable (question). Questions that were not answered were

[24] Stata is a general-purpose statistical software package created in 1985 by StataCorp. Most of its users work in research, especially in the fields of economics, sociology, political science, biomedicine and epidemiology

left blank (Stata treats them as string variables). The excel sheets were then uploaded into the STATA platform for analysis.

The data collection process was challenging. Not many funds were available for data collection; therefore, the survey questionnaire documents' preparation and postage were borne solely by the researcher with tremendous and appreciable help from the lead supervisor, Professor Paul Stretesky. Extra hours and efforts were spent printing out the surveys and putting them together. There were no incentives for respondents, which may have contributed to the survey's low response rate (just about 198 returned the survey).

Another problem that was encountered during the data collection phase is the issue of missing surveys in the post. Some respondents reported that there was no survey questionnaire in their package, and others also reported that the package was opened before it was delivered. Although the research team suspected some foul-play, little attention was paid to this issue as the data received is statistically adequate to draw a meaningful conclusion.

5.10 Research Ethics.

The Northumbria University Ethics Committee endorsed the protocol for the data collection. Adhering to the ethical procedures safeguarded participants against the potential harm of the research. It provided participants with the choice to participate in the study or not, i.e., allowed for informed consent (Hammersley & Traianou, 2014). Participants consent to participate in the research was clearly stated in the introductory letter attached to the survey questionnaire (see Appendix I).

The informed consent message covered information on the potential risk and benefit of the research project to participants, what data will be needed, and how confidentiality will be

ensured. The respondent's anonymity was guaranteed by not asking for their identity, i.e., their name and address, and random codes were assigned to each returned survey questionnaire.

5.11 Chapter Summary

This chapter described the research approach and methodology. It discussed the research methods and how the survey questionnaire approach was suitable for the present research. It also described the context and justification for selecting the cross-sectional method for data collection. The method employed for data collection and analysis and challenges encountered during the data collection phase was also addressed. Finally, it discussed the ethics issue.

Chapter Six is the first analysis chapter. That chapter will answer research question 2: Do residents in the Preston community report that hydraulic fracturing is linked to stress measured by the IES-R. The chapter also discusses further implications of the results.

6.0 CHAPTER SIX: ANALYSIS OF TOTAL IES-R SCORE AND IT'S IMPLICATIONS

6.1 Introduction

This chapter answers the research question two: **Do residents in the Preston community report that hydraulic fracturing is linked to stress measured by the IES-R?** This research question will be answered by evaluating the revised Impacts of Event Scale (IES-R). As previously noted, the IES-R is one of the most commonly used metrics for assessing posttraumatic stress symptomology (Weiss & Marmar, 1997; Weiss, 2007). Chapter Four suggested a useful index to examine shale gas-related stress at Preston-New- Road. This chapter begins by statistically analysing the respondents' response on the 22-item IES-R scale, and then the results are discussed.

6.2 Results of Analysis of the Total IES-R Scale.

The Impact of Event Scale-Revised (IES-R) is a 22-item, self-report Likert-type measure that assesses posttraumatic stress symptoms on a scale from 0 (not at all) to 4 (extremely) concerning a specific event. Respondents report how certain distressing difficulties related to the event have been over the past seven days (e.g., "I tried not to think about it."). Participants in the current study responded to the scale concerning exploratory drilling by hydraulic fracturing in the Preston-New-Road sites.

Scoring of the IES-R includes a total score (ranging from 0–88) and three subscales reflecting avoidance (e.g., deliberate efforts to avoid thinking or talking about the traumatic event), intrusion (e.g., thoughts or feelings about the traumatic event arising without conscious effort), and hyperarousal (e.g., an exaggerated startle response, angry outbursts, hypervigilance). These subscales correspond with the DSM-IV definition of

post-traumatic stress (American Psychiatric Association, 2000). Higher total (or subscale) scores reflect higher levels of distress.

While the IES-R is not generally used to diagnose PTSD, cut-off scores for a preliminary diagnosis have been proposed. Total IES-R Scores above 24 reflect significant clinical concern (Asukai et al., 2002), scores above 33 reflect a probable diagnosis of PTSD (Creamer et al., 2003), and scores above 37 reflect long-term suppression of immune system functioning (Kawamura et al., 2001). High levels of internal consistency on the total score have been established across various samples (Cronbach's α = .95-.96).

The IES-R score is analysed by evaluating the total IES-R score and the mean of the subscales. The total score for each subscale is calculated using the mean of the score response. Scores will range from 0 to 4. The amount of distress the respondent is experiencing corresponds, therefore, to the categories on the scale. For instance, a respondent with a mean score of 3 in the avoidance subscale displays "quite a bit" of avoidance behaviour.

IES-R Category	Frequency	Percentage of respondents	Cumulative frequency
Non-clinical concerns (score 0 to 24)	168	85.24	85.24
Clinical concerns (score from 25 to 33)	13	6.60	91.88
Probably diagnosis (score from 34 to 37)	2	1.02	92.89
Immune suppression (scores above 37)	14	7.11	100.00
Total	197		

Table 6.1: Frequency distribution table of the Total IES-R score.

The total number of responses for the total IES-R questions were 197. Of these, just over 15% of the respondent's report scores are large enough to indicate psychosocial stress symptoms because of hydraulic fracturing in the community. About 7% reported high enough scores to prompt significant clinical concerns, and just about 1% of scores were high enough to suggest psychosocial stress and an impact on the immune system.

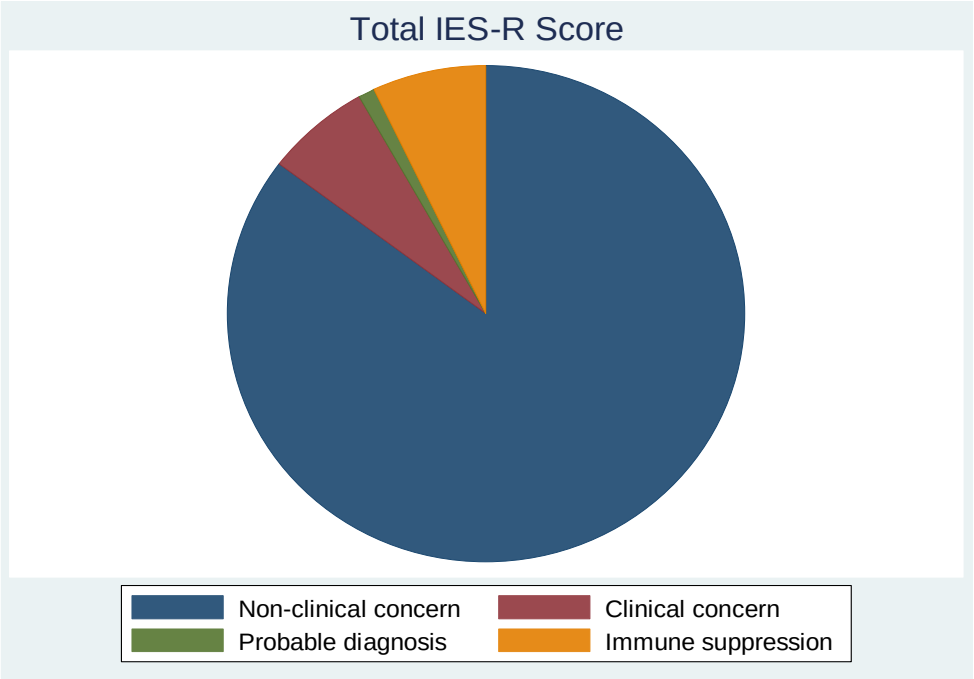

Figure 6.1: Pie chart of the Total IES-R Scale

Avoidance Subscale

The avoidance subscale is the deliberate efforts to avoid thinking or talking about the traumatic event. The responses are in the range of 0 to 4. A response of 0 means the respondent did not exhibit avoidance behaviour. A response of 1 means the respondent exhibited a little bit of avoidance behaviour. A response of 2 means the respondent exhibited quite a bit of avoidance behaviour, and a response of 4 means the respondent exhibited extreme avoidance behaviour. On the IES-R, the avoidance subscale is the mean item response of items 5. 7. 8, 11, 12, 13, 17, and 22.

Item	Corresponding question
5	I avoided getting myself get upset when I thought about it or was reminded of it
7	I felt as if it hadn't happened or wasn't real
8	I stayed away from reminders of it
11	I tried not to think about it.
12	I was aware that I still had a lot of feelings about it, but I didn't deal with them.
13	My feeling about it was kind of numb
17	I tried to remove it from my memory
22	I tried not to talk about it.

Table 6.2: Questions on the avoidance subscale of the IES-R

Avoidance symptoms	Freq	Percentage	Cum
Not at all	134	68.02	68.02
A little bit of	49	24.89	92.89
Moderately	13	6.06	99.49
Extremely	1	0.51	100.00
	197		

Table6.3: Frequency distribution table of the avoidance subscale

The number of respondents for the avoidance subscale is 197. Of these, about 68% did not exhibit any avoidance symptoms, just about 25% exhibited a little bit of avoidance symptoms. 13% exhibited moderate avoidance symptoms, and 0.5% exhibited extreme avoidance symptoms.

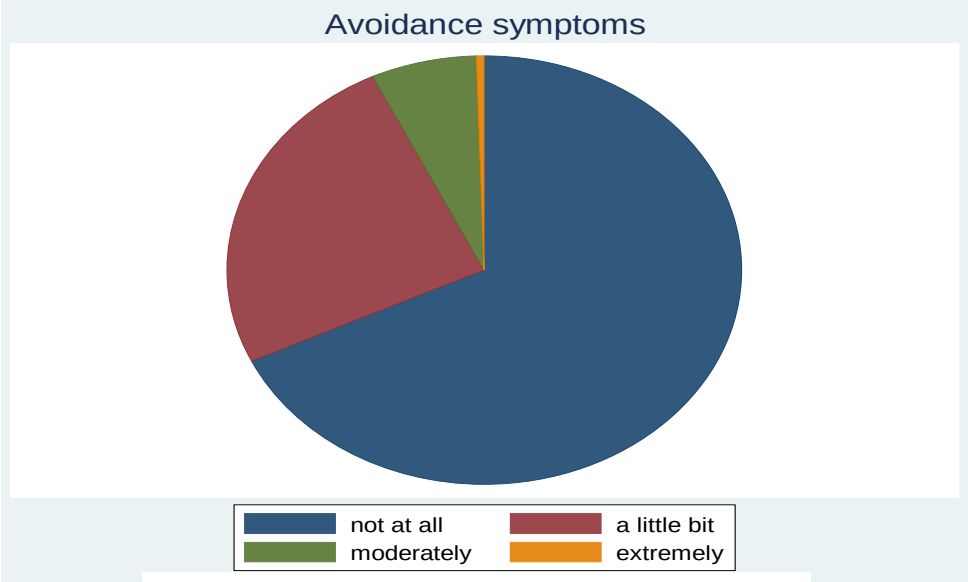

Figure 6.2: Pie chat of avoidance symptoms

Intrusion Subscale

The intrusion subscale is the thoughts or feelings about the traumatic event arising without conscious effort. As with the avoidance subscale, the intrusion subscale is also categorized from 0 (not at all) to 4 (extremely). A response of 0 means the respondent did not exhibit intrusion behaviour. A response of 1 means the respondent exhibited a little bit of intrusion behaviour. A response of 2 means the respondent exhibited quite a bit of intrusion behaviour, and a response of 4 means the respondent exhibited extreme intrusion behaviour.

Item	Corresponding question
1	Any reminder brought back feelings about it.
2	I had trouble staying asleep.
3	Other things kept making me think about it.
6	I thought about it when I didn't mean to.
9	Pictures about it popped into my mind.
14	I found myself acting or feeling like I was back at that time.
16	I had waves of strong feelings about it.
20	I had dreams about it.

Table 6.4: Question items on the intrusion scale of the IES-R

Intrusion symptoms	Freq	Percentage	Cum
Not at all	132	67.01	67.01
A little bit of	35	17.77	84.77
Moderately	21	10.66	95.43
Quite a bit	8	4.06	99.49
Extremely	1	0.51	100.00
	197		

Table 6.5: Frequency distribution table of intrusion subscale

The total response for the intrusion symptoms subscale is 197. About 67% of the respondents did not exhibit intrusion symptoms. About 18% of respondents exhibited a little bit of intrusion symptoms. Just about 11% exhibited moderate intrusion symptoms. Just over 8% exhibited quite a bit of intrusion symptoms, and about 0.5% experienced extreme intrusion symptoms.

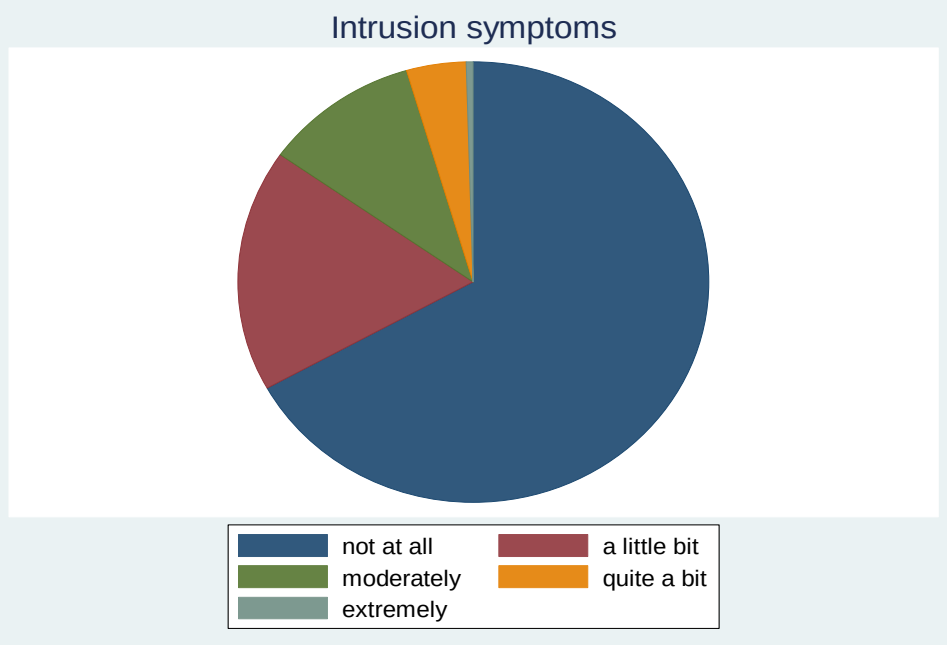

Figure 6.3: Pie chart of intrusion symptoms.

Hyperarousal Subscale

The hyperarousal subscale is the feeling of exaggerated startle response, angry outbursts, and hypervigilance. On the IES-R, question items 4, 10, 15, 18, 19, and 21 make up the hyperarousal subscale. This subscale is also categorized between 0 (not at all) to 4 (extremely), where a response of 0 means the respondent did not exhibit hyperarousal behaviour, a response of 1 means the respondent exhibited a little bit of hyperarousal behaviour, a response of 2 means the respondent exhibited quite a bit of hyperarousal behaviour, and a response of 4 means the respondent exhibited extreme hyperarousal behaviour.

On the IES-R, the hyperarousal subscales are made up of six items, and they are items 4, 10, 15, 18, 19, and 21.

Item	Corresponding question
4	I felt irritable and angry
10	I was jumpy and easily startled
15	I had trouble falling asleep
18	I had trouble concentrating
19	Reminder of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or a pounding heart
21	I felt watchful and on-guard.

Table 6.6: Question items on the Hyperarousal scale of the IES-R scale

From Table 6.6 below, the total number of responses for the hyperarousal subscale is 152 respondents. Just over 77% of respondents did not exhibit hyperarousal symptoms. About 15% of respondents exhibited a little bit of hyperarousal symptoms. Just about 5% exhibited moderate hyperarousal symptoms. Just over 2% exhibited quite a bit of hyperarousal symptoms, and about 1% experienced extreme intrusion symptoms.

Hyperarousal symptoms	Freq	Percentage	Cumulative frequency
Not at all	152	77.16	77.16
A little bit of	30	15.23	92.39
Moderately	9	4.57	96.95
Quite a bit	4	2.03	98.98
Extremely	2	1.02	100.00
	197		

Table 6.7: Frequency distribution table of hyperarousal symptoms

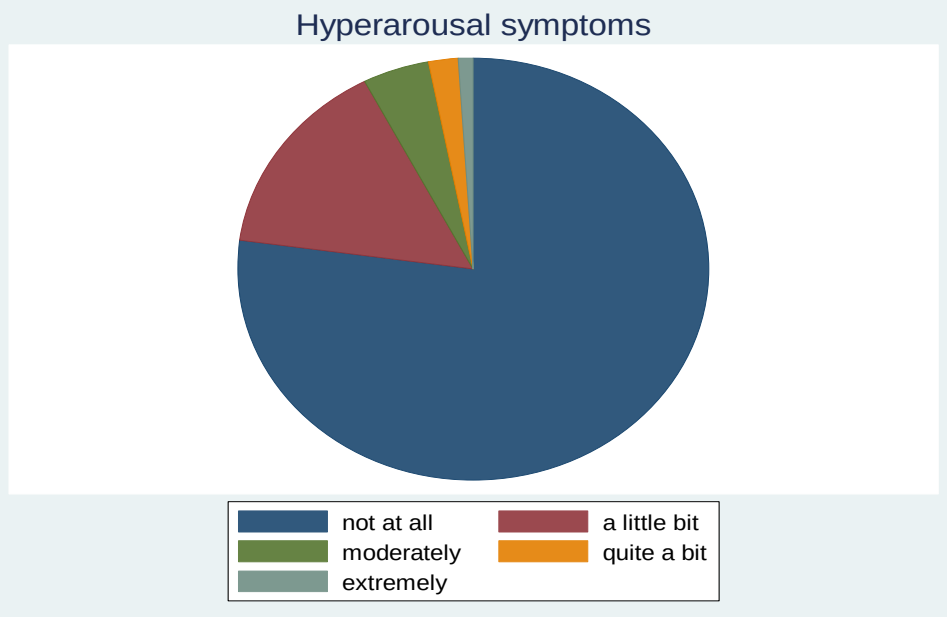

Figure 6.4: Pie chart of hyperarousal symptoms.

6.3 Discussion of Results

Table 6.1 above shows that about 14.73% exhibited psychosocial stress symptoms, with as much as 7.11% exhibiting symptoms at an immune suppression level. On the Avoidance subscale table, i.e., Table 6.3, 31.46% of the respondents exhibited psychosocial stress related to avoidance stress symptoms. On the intrusion subscale table i.e., Table 6.5, approximately 33.00% exhibited psychosocial stress related to intrusion stress symptoms, and finally, on the hyperarousal subscale, i.e., Table 6.7 approximately 22.75% of respondents, exhibited psychosocial stress symptoms related to hyperarousal stress.

These findings are significant as it confirms that indeed psychosocial stress is related to hydraulic fracturing. Szolucha (2016), in her ethnographic research, also confirmed that psychosocial stress is indeed associated with hydraulic fracturing in Lancashire. She found that fracking on the Preston-New-Road site has generated diverse reactions from residents of Lancashire. Many individuals decided voluntarily to become part of the planning process concerning Cuadrilla Mining Resource application for shale gas development. Without exception, all the community members engaged in the planning process reported significant stress and anxiety (Szolucha, 2016b).

One resident involved in the planning process stated that:

> It's not something that you can do in a superficial way, and it's bound to cause anxiety and be stressful. It's more of a challenge really and working with people who are a hugely supportive group and that takes a lot of stress away... Dealing with the police – I try to keep that, I don't want to be friends with them. I just don't want them to beat up my mates really – that's the intention… It's a challenge but some of these situations are very stressful... Mental health and well-being are definitely affected and it takes over lives. It becomes all consuming. It dominates lives. It forces you to do things like the House of Lords [….] that was a biggie to actually do that and survive it and perform reasonably well. It's stressful particularly if you've got one of the pads across the road from you. It's balanced by the positives, being surrounded by and finding this wonderful community with values. (Szolucha, 2016, pp26-27).

Another resident that lives close to the Preston-New-Road fracking sites also stated that:

> It's the lack of balance in people's lives any more. You know, for people to have a decent quality of life, you've obviously got your home, your work, your family, you have those pillars... that is not the life that any of us are living. We're sole-track, totally going down this route and there is nothing else. (Szolucha, 2016, p27).

These stress and anxiety feelings are mainly related to demands from the residents' participation in the planning process and grassroots activism. These activities involve public speaking, interaction with the police, media, and political stakeholders, and other factors such as struggling for money to hire professional consultants. Furthermore, the needs to be able to read, understand, and coordinate response to documentation prepared by the gas company and the authorities within tight deadlines is stressful for the residents. A resident in Singleton stated that:

> The biggest thing is the actual time commitment. It involves a huge time commitment and that on some people can have a huge impact so you've either got to say that I'm in this for the long haul or I can't actually cope with that amount of stress. (Szolucha, 2016, p27).

Another source of stress that has been expressed by residents is the strain on the family and other relationships caused by engagement in the fracking issues. One resident stated that:

> All small housework are on a back burner and that adds to the pressure. I'm quite resilient, just the odd days when I go into a panic mode. There was a couple of times when I got really stressed. One time I remember screaming at my son because somebody was coming to visit me and I haven't sorted out what I was doing and I lost it. I was probably a bit out of control at that time. Last night, [there was an] FFL meeting and [name] was making dinner cause I was doing something on a computer and I was really frustrated cause tea was already late and I knew that I was going to get picked up in ten minutes so I had ten minutes in which to eat my dinner and then I felt awful because I was leaving them to it to clean up and do everything, I felt guilty… [I had] guilt conscience that I'm neglecting my family. (Szolucha, 2016, p28).

In this same vein, another resident stated that:

> It has infiltrated people's lives to such a degree that they basically almost live and breathe fracking and that is not a good state of mind to be in because you might have family members who are or not so bothered and that creates a bonfire, fuel adds to the fire all the time. You come with a new bit of evidence or you met somebody else. You come back after a working day and there you are, you're talking about it again and living it again. It goes on and on like that. It's not good. You look for a bit of escapism where you switch off for a while, but there is always something that lurks in the background and raises its head again locally and other. (Szolucha, 2016, p28).

Most residents are already retired or nearing retirement (Szolucha, 2016b), and their perception that they are fighting an uphill task where the national government is on the side of the industry has been another source of stress. One resident stated that

> There are people here who are stressed, distraught... there are people here who are having sleepless nights, cry over the very thought of it. It beggars belief that people have to feel that way. It's wrong… I had a high pressure job when I was with [name of the company] so I learned to cope and it reminds me of the pressure of the job I had then. The travelling, the worries that you have. The annoying thing is that I'm meant to be on a wind-down to retirement and I wasn't expecting to be doing all this work. My idea was to come home from work, do a few jobs, go for a walk or yoga. - Life is full of stresses, it's the stress of providing for your family but then you have something like this which is the stresses of a force out there to oppress you, trying to literally deceive and take from you... It's a very stressful situation. It's a situation where it's putting a cloud over daily existence, over what the future holds. It is literally almost like a war sort of a footing because it's a force, it's this company that's so well in the government and it's so unbelievable really that they could have such a strong influence on the government through the old boy network and all the millionaires... They have such a corrupted effect on the government when you see people like Amber Rudd and other people from the Department of Energy and Climate Change who should be there, who should be about climate change, but they are ignoring their job titles and just act as puppets for Cameron and Osborne (Szolucha, 2016, p29).

Another source of stress is the local residents' perception that Cuadrilla is not being truthful about fracking detail and is not responsive to the question they have been raising. One local resident, therefore, stated that:

> In the early days, ... I went to a meeting by Cuadrilla that they had and I came away with many many more questions because they weren't telling the truth. They were dodging my questions; they weren't

> answering them directly, lying in some cases and so that's what spurred me on because they were this company who landed in my community and they weren't being truthful. I knew that from the beginning… A lot of my questions were about the health impacts and they said there weren't any. And chemical use, I said, what chemicals are you planning to use here? Because I knew that was linked to health impacts of the people in the US. And they said: 'we're not going to use any chemicals. We're gonna use, it's nothing nasty. It's what you find in contact lenses'. He was trying to say that it was things that you've got in your kitchen cupboard so he was trying to normalise it. That was all 'very benign, it's nothing (Szolucha, 2016, p34).

6.4 Chapter Summary.

This chapter answered research question two: Do residents in the Preston community report that hydraulic fracturing increases community stress/disruption? The total IES-R scale and the mean of the three subscales confirm that indeed hydraulic fracturing operations induce psychosocial stress in local communities. The next chapter is the second analysis chapter, and it answers research question 3; Do the sociological concepts of community attachment, recreancy, and social capital discussed in chapter three help explain the variation in fracking-related stress in the Preston community.

7.0 CHAPTER 7: MULTIVARIATE ANALYSIS

7.1 Introduction

This chapter uses multivariate analyses to answer the third research question: **Do the sociological concepts of community attachment, social capital, and perception of recreancy help explain the variation in fracking-related stress in the Preston community?** Chapter three provided the theoretical justification for using the following concepts as predictors of hydraulic fracturing related stress in the PNR community: (1) Community Attachment, (2) Social Capital, and (3) Perception of Recreancy.

The specific variables used to measure each of these concepts will be reviewed in this chapter and then analysed using ordinary least squares regression (OLS). The IES is the dependent variable, and factors that measure concepts of community attachment, perception of recreancy, and social capital are the independent variables. Recall from the general hypotheses in Chapter Three that an increase in community attachment would correspond to an increase in fracking-related stress; an increase in social capital is likely to be associated with an increase in fracking-related stress; an increase in perception of recreancy will correspond to an increase in fracking-related stress.

This chapter begins by describing OLS. Next, the chapter examines the survey items that were used to create the community attachment, social capital, and the perception of recreancy variables. Each section will examine the bivariate regression equations between these concepts and stress. The chapter ends by producing the best stress model to determine the best predictors of the variation in community stress/disruption in the Preston-New-Road community.

7.2 Ordinary Least Squares Regression.

Ordinary least squares (OLS) regression is a statistical method of analysis that estimates the relationship between independent and dependent variables. This method calculates the relationship by minimizing the sum of squares in the difference between the observed and predicted values of the dependent variable configured as a straight line. OLS can be applied to a bivariate model, that is, a model in which there is only one independent variable (x), predicting one dependent variable (y). It can also be applied to a multivariate model in which there are two or more independent variables (i.e., x_1, $x_2 \ldots x_n$) predicting one dependent variable. Suppose the relationship is assumed to be linear. In that case, bivariate regression may be used to address this issue by fitting a straight line to a scatterplot of observations on x and y. The most straightforward statement of such a relationship between an independent variable, labelled x, and a dependent variable, labelled y, may be expressed as a straight line in this formula:

$$y = \alpha + \beta x$$

where α is the intercept of the line on the y axis,
and β is the slope of the line.

This equation describes the direct linear relationship between x and y where the value of y can be precisely calculated from the value of x. The line's slope can be described as the change in y, which is associated with a unit change in x. The line's slope corresponds to the regression coefficient and represents the explanatory variable's potential effect on the response variable (i.e., this is a possible effect since correlation does not mean causation but is only one of the conditions needed to establish cause). Figure 7.1 below depicts the regression line for two variables that are perfectly linearly related and shows the regression coefficient β and the intercept, α.

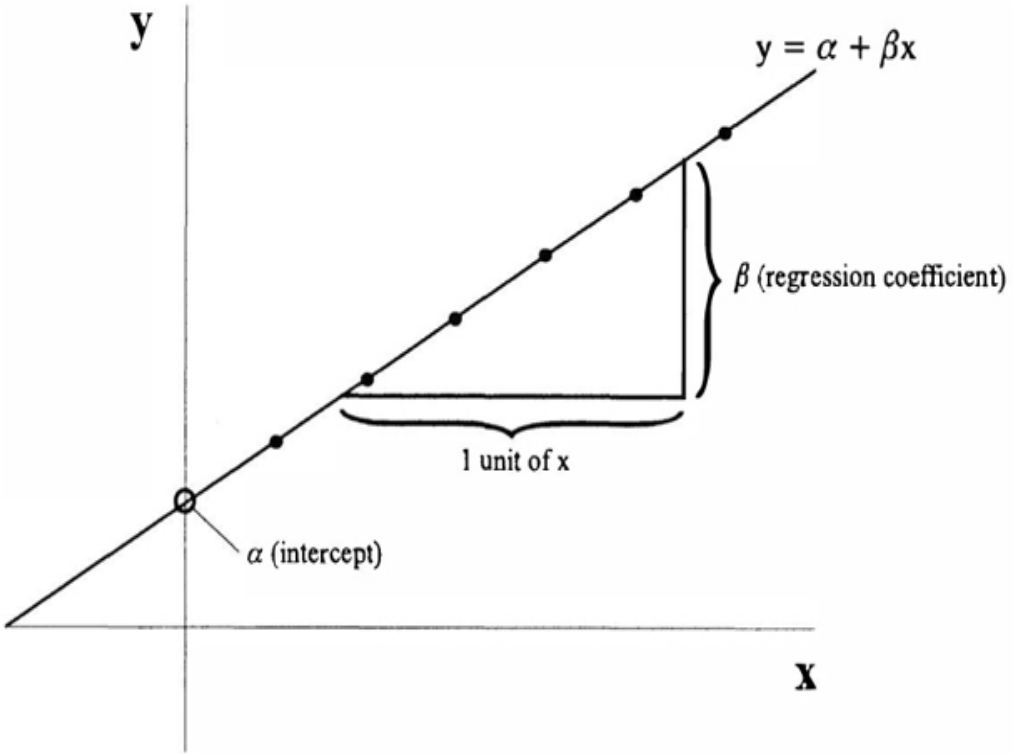

Figure 7.1: An OLS regression model depicting a perfect linear relationship. (source: Hutcheson, 1999, p.4).

However, this perfect relationship of the type shown in Figure 7.1 above are the exception rather than the rule, as relationships are rarely perfect, and measurements are rarely error-free. The best that can be done is to calculate a line of best-fit to describe the relationship between x and y. For OLS regression, the most common method for calculating this line is to use the least-squares procedure, which minimizes the sum of the squared deviations, known as error or residual, of each data point from the line.

$$y = \alpha + \beta x + \varepsilon$$

In this formula, α now represents the average value of y when x=0, whilst β represents the average change in y associated with a unit change in x.

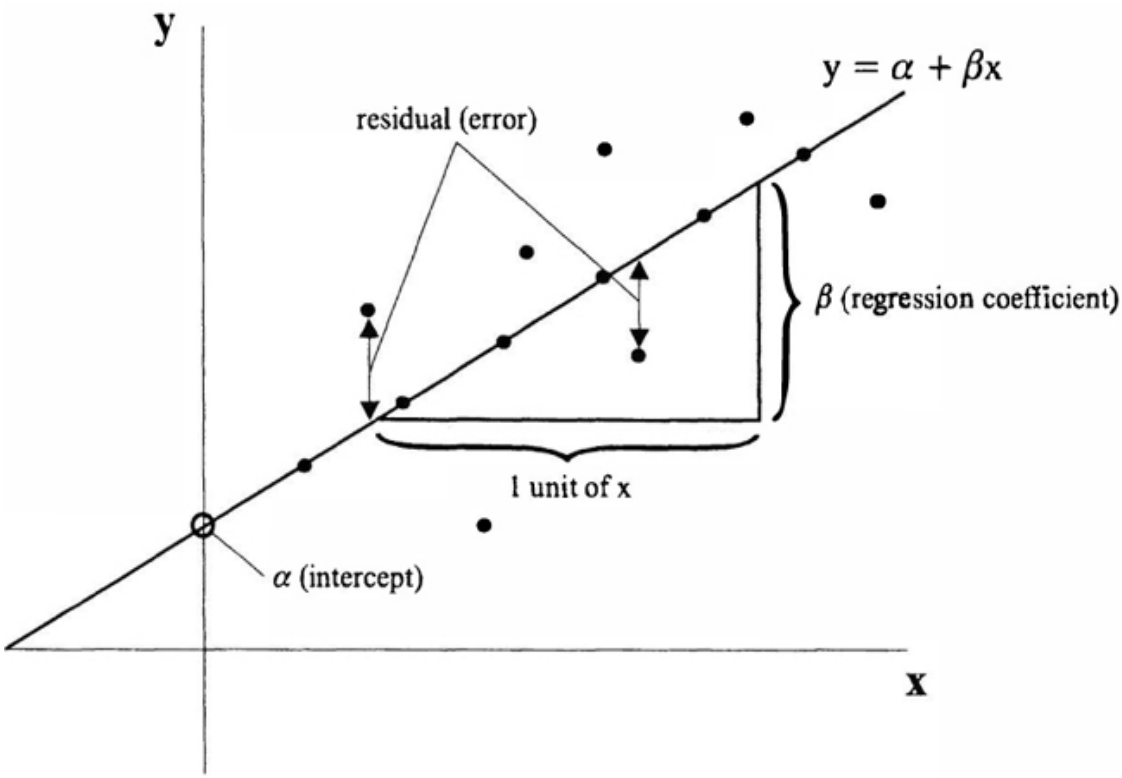

Figure 7.2: Line of best fit for two imperfectly related variables. (Source: Hutcheson, 1999, p.5).

The error term indicated that the relationship predicted in the equation is not perfect. That is, the straight line does not perfectly predict y. This lack of a perfect prediction is common in the social sciences. For instance, if the variable above were the age of PNR resident and level of stress/distress, we would not expect all women who were 25 to have a score of exactly 20 points on the stress scale. As a result, there is some variation (or error) around the regression line. There are several assumptions about how the error is distributed around this regression line, and that will be reviewed below.

In sum, social scientists are often concerned with questions about the relationship between two variables (see Lewis-Beck & Lewis-Beck, 2015; Vittinghoff et al., 2012), and this thesis is no exception. In particular, the third research question seeks to find the best predictors of stress/distress, which are those variables that are the most strongly related to

stress/distress in OLS regression models. Next, I review the assumptions of the OLS that should be addressed when modelling data.

Assumption of the OLS Model: (Pevalin & Robson, 2009, p.288-289)

The primary assumptions of the OLS regression are as follows:

a. The independent variables are measured without errors
b. The model is properly specified so that it includes all relevant variables are included, and all irrelevant variables are excluded
c. The association between the independent variables and the dependent variables are linear (or can be transformed in order to represent a linear relationship)
d. The error (i.e., the difference between the actual values and that predicted by the regression line) is normally distributed.
e. The variance of the error term is constant, meaning that it does not vary over different values of the dependent variable(s). This condition is referred to as homoscedasticity. When this assumption is violated there is heteroscedasticity in the data.
f. The errors associated with one observation are not correlated with the errors associated with another observation
g. The errors are not correlated with any of the independent variables.

Other Technical Issues

h. Strange cases or outliers: these may be from coding errors or maybe truly different in which case it may need to be examined further
i. Leverage and influence: to determine if any of the cases have undue leverage or power on the regression line

j. Multicollinearity: if the independent variables are highly correlated with one another, this may affect the regression estimates.

The next section discusses the community attachment variables and how they are combined to generate the community attachment additive scale. It also discusses the use of OLS to analyse the community attachment additive scale to test the hypotheses on community attachment and psychosocial stress.

7.3 Community Attachment Index

Chapter three suggested that community attachment can be a source of stress. That is, as community attachment goes up, IES will go up. Kasarda & Janowitz (1974) and Wirth (1938) defined community attachment as a reflection of the solidarity of social relations among the residents in a community. According to them "the local community is viewed as a complex system of friendship and kinship networks and formal and informal associational ties rooted in family life and ongoing socialization process" (Kasarda & Janowitz, 1974, p.329). Community attachment is measured using an index comprising of two separate questions from The PNR survey questionnaire.

Question one: How proud are you to live in this community? This question was coded '1' for respondents that are not at all proud to live in their community, '2' for respondents that are slightly proud to live in their community, '3' for respondents that are moderately proud to live in their community, '4' for respondents that are very proud to live in their community, and '5' for respondents that are extremely proud to live in their community.

Approximately 38% of the respondents are very proud to live in the Westby and Wrea Green community, about 27% of respondents are moderately proud to live in the Westby and Wrea Green community, about 19% are extremely proud to live in the Westby and

Wrea Green community, about 11% are slightly proud to live in the Westby and Wrea Green community. Approximately 6% are not at all proud to live in the Westby and Wrea Green community. The total number of respondents for this response is 181, the mean score of the response is 3.52, the standard deviation is 1.10, and the minimum and maximum values are 1 and 5, respectively.

Question two: How strong is your sense of community? This question was coded '1' for respondents that think there is not at all strong sense of community in the Westby and Wrea Green community, '2' for respondents that think there is a slightly strong sense of community in the Westby and Wrea Green Community, '3' for respondents that think there is a moderately strong sense of community in the Westy and Wrea Green community, '4' for respondents that think there is a very strong sense of community in the Westby and Wrea Green community, and '5' for respondents that think there is extremely strong sense of community in the Westby and Wrea Green community.

Approximately 36% of the respondents think there is a very strong sense of community in the Westy and Wrea Green community. About 31% of the respondents think there is a moderately strong sense of community in the Westy and Wrea Green community, and approximately 12% of the respondents thinks there is a slightly strong sense of community in the Westy and Wrea Green community, and about 11% of respondents thinks there no sense of community in the Westy and Wrea Green community. Finally, about 10% of the respondents think there is an extremely strong sense of community in the community.

Community Attachment Indicator

To measure community attachment, I used the two questions described above to produce a community attachment additive scale. To create this indicator, I added the individual responses to each of the two questions up for each individual for the 180 individuals that

answered these questions, i.e., I created an additive scale of these two community attachment variables. The way that the questions are coded suggests that someone reporting the lowest level of the community attachment indicator on each variable could score as low as '2' on this scale. Someone reporting the highest levels of recreancy on each variable could score as high as '10'. The total number of observations for the community attachment indicator is 180. This means that 180 individuals answered each of the two questions used in this index. The mean of the community attachment indicator is 6.77 (std. dev. = 4.51). The minimum and maximum values are 2 and 10, respectively.

To better understand how the community attachment index comes together, I test the community attachment scale's reliability in Stata using Cronbach's Alpha. In Stata, the command for Cronbach's Alpha is 'alpha'. As a general rule, an alpha score above 0.70 is good (Pevalin & Robson, 2009). It suggests that the items (in this case, the two community attachment variables) used in a scale are internally consistent, meaning that together they form a good (i.e., reliable) community attachment indicator. The alpha for the two community attachment items that make up the community attachment indicator is 0.79. Thus, these variables appear to be a reliable indicator of the community attachment indicator.

I now specifically hypothesize:

H1. As community attachment indicator scores increase across Preston-New-Road residents, overall IES-R scores would also increase.

H2. As community attachment indicator scores increase across Preston-New-Road residents, overall IES-Avoidance scores would also increase.

H3. As community attachment indicator scores increase across Preston-New-Road residents, overall IES-Intrusion scores would also increase.

H4. As community attachment indicator scores increase across Preston-New-Road residents, overall IES-Hyperarousal scores would also increase.

I test these hypotheses using bi-variate analysis using OLS regression where the independent variable is the community attachment indicator, and the dependent variables are IES-R, Avoidance, Intrusion and Hyper-Arousal subscales.

Table 7.1 Ordinary Least Squares Regression Coefficients (*b*) and Standard Errors (SE) for Community Attachment predictors of IES-R

Stress	Overall IES-R		Avoidance		Intrusion		Hyperarousal	
	b	SE	*b*	SE	*b*	SE	*b*	SE
Community Attachment Indicator	-0.04	0.54	0.02	0.19	0.06	0.24	-0.12	0.16
Constant	10.22	3.82	3.14	1.32	3.95	1.71	3.14	1.12
N	180		180		180		180	
Adjusted R^2	-0.0056		-0.0055		-0.0053		-0.0023	

Note: ***p<0.001, **p<0.01, *p<0.05 significance (two-tailed).

According to Table 7.1, the overall IES-R scale is unrelated to stress. In particular, the community attachment indicator is not statistically significant (p>0.05) in any of the models in Table 7.1. Therefore, we fail to reject the null hypothesis that there is no relationship between community attachment and stress. As a result, hypothesis H1 that community attachment and IES-R scores are correlated is not supported by these data.

According to Table 7.1, the overall IES Avoidance scale is also not significant. Again, we fail to reject the null hypothesis. Thus, for hypothesis H2, there is little support that among Preston-New-Road residents community attachment indicator score is related to the IES Avoidance scores. These same findings are true for the IES intrusion scale and the IES hyperarousal scale, which are also statistically insignificant. Thus, there is also little support for hypothesis H3 and hypothesis H4.

The next section discusses the social capital variables and how they are combined to generate the social capital additive scale. It also discusses the use of OLS to analyse the social capital additive scale to test the hypotheses on social capital and psychosocial stress.

7.4 Social Capital Index

Recall that as a concept, social capital is the level and kind of relationships or interactions that exist between individuals and organisations (Narayan-Parker, 1999). Social capital is measured using an index comprised of eight questions from the PNR survey questionnaire. I describe each of those eight questions below and explain how each was coded. I provide descriptive statistics for each of the variables and then explain how they were combined to compute a social capital indicator variable that can be used to test the relationship between social capital and fracking-related stress.

The social capital index is used because it reduces co-variate space and minimises violations of assumptions dealing with multicollinearity. That is, rather than examine the relationship between each of the eight social capital variables and stress, which may produce problems of multi-collinearity and reduce degrees of freedom, this analysis combines similar questions into a single concept to test the general hypothesis. Recall, the social capital hypothesis states that increased social capital levels predict increased levels of stress/distress, as discussed in chapter three, page 102. Eight questions are described below and combined to produce the social capital indicator used in the OLS analysis.

Question one: Approximately how many people will you count as close friends, that you (and perhaps your family if appropriate) talk to or associate with frequently in this community? This question was coded ‘1’ for the respondents who counts between 0 – 5 people as close friends, ‘2’ for the respondents who count between 6 – 11people as close friends, ‘3’ for the respondents who count between 12 – 17people as close friends, and ‘4’

for the respondents who count 18 or more people as close friends. Approximately 48% of respondents count 18 or more people as close friends they associate with within the community. About 24% of respondents count between 12-17people as close friends who they associate with within the community.

Approximately 15% also counts between 0 – 5 people as close friends that they associate with regularly, and about 14% of the respondents associate with between 12 – 17 people as close friends in the community. The total number of respondents for this variable is 183. The mean of this variable is 2.94, the standard deviation is 1.14, the minimum value is 1, and the maximum value is 4.

Question two: How often this week have you had face-to-face contact with at least one of your relatives or friends in this community, excluding the people you live with? This question was coded '1' for those who have face to face contact with between 0 – 5 people, '2' for those who have face-to-face contact with between 6 – 11people, '3' for those who have face-to-face contact with between 12 – 17 people, and '4' for those who have face-to-face contact with 18 or more people.

About 41% of respondents have had face-to-face with between 0 – 5 people, and approximately 30% of respondents have had face-to-face contact with between 6 and 11 people. Just about 15% of respondents have face-to-face contacts with about 18 or more people, and finally, approximately 14% of respondents have face-to-face contact with between 12-17 people. The total number of responses for this variable is 182. The mean score is 2.03, the standard deviation is 1.08, the minimum value is 1, and the maximum is 4.

Question three: Of your close friends and relatives, how many live in the Westby and Wrea Green area? This question was coded '1' for those who have between 0 – 5 close

friends and relatives in the Wrea Green area, ‘2’ for those who have between 6 – 11 close friends and relatives in the Wrea Green area, ‘3’ for those who have between 12 – 17 close friends and relatives in the Wrea Green area, and ‘4’ for those who have 18 or more close friends and relatives in the Wrea Green area. About 41% of respondents have between 0 – 5 friends and relatives in the Westby and Wrea Green area. Approximately 30% of respondents have between 6 – 11 friends and relatives in the Westby and Wrea Green area. About 15% have about 18 or more close friends and relatives in the Westby and Wrea Green, and finally, approximately 14% have between 12-17 friends and relatives in the Westby and Wrea Green area. The total number of respondents for this variable is 182. The mean score is 2.03, and the standard deviation is 1.08. The minimum and maximum values are 1 and 4, respectively.

Question four: Approximately how many people do you speak with within your community on a regular basis (excluding those you live with)? This question was coded ‘1’ for those who speak with between 0 – 5people, ‘2’ for those who speak with between 6 – 11people, ‘3’ for those who speak with between 12 – 17 people, and ‘4’ for those who speak with 18 or more people. About 36% of respondents speak with between 6 – 11 people on a regular basis, and about 26% of residents also speak with between 0 – 5 people on a regular basis. Likewise, just about 26% of respondents speak with at least 18 people on a regular basis, and approximately 11% of respondents speak with between 12 – 17 people on a regular basis. The total responses for this variable are 184. The mean score is 2.38, the standard deviation is 1.13, and the minimum and maximum values are 1 and 4, respectively.

Question five: How often (weekly) did you socialise with your neighbours or people before exploratory drilling started in Westby and Wrea Green area? This question was coded ‘1’ for those who socialize with their neighbours between 0 – 5 times in a week, ‘2’

for those who socialize with their neighbours between 6 – 11 times in a week, ‘3’ for those who socialize with their neighbours between 12 – 17 times in a week, and ‘4’ for those who socialize with their neighbours 18 or more times in a week.

Approximately 45% of respondents socialized at most five times with their neighbours before exploratory hydraulic fracturing commenced, and just about 31% socialized with their neighbours between 6 – 11 times in a week. Approximately 15% of respondents socialized at least 18 times with their neighbours before exploratory hydraulic fracturing, and approximately 9% of respondents socialized between 12 – 17 times with their neighbours before exploratory hydraulic fracturing started. The total number of responses for this variable is 181. The mean score is 1.94, and the standard deviation is 1.07. The minimum and maximum values are 1 and 4, respectively.

Question six: In a one-month period, how often do you help out as a volunteer in the Westby and Wrea Green community before exploratory drilling?
This question was coded ‘0’ for those who never volunteer, ‘1’ for those who volunteer between 1 – 5 times in a month, ‘2’ for those who volunteer between 6 – 11times in a month, ‘3’ for those who volunteer between 12 – 17 times in a month, and ‘4’ for those who volunteer 18 or more times in a month.

Approximately 73% of respondents never help out as volunteers in the Westby and Wrea Green area. Approximately 23% of respondents help as volunteers between 1 – 5 times in a one-month period in the Westby and Wrea Green area. Just about 2% of respondents help as volunteers at least 18 times, and approximately 2% also help as volunteers between 6 – 11 times in a one-month period. Finally, around 1% help as volunteers between 12 – 17 times in a one-month period. The total number of respondents for this variable are 183

responses. The mean score is 0.37, and the standard deviation is 0.75. The minimum and maximum values are 0 and 4, respectively.

Question seven: How often do you participate in activities such as community/village fair that happen in this neighbourhood before exploratory drilling for shale gas? This question was coded '1' for respondents who don't often participate in community/village fair, '2' for respondents who slightly often participate in community/village fair, '3' for respondents who moderately often participate in community/village fair, '4' for respondents who very often participate in community/village fair, and '5' for those who extremely often participate in community/village fair.

About 42% of respondents did not at all often participate in community/village fair, and approximately 32% of respondents slightly often participate in community/village fair activities. Just about 16% moderately often participate in community/village fair activities, and approximately 9% of respondents very often participate in community/village fair activities. Finally, about 1% of the respondents stated that they participate in community/village fair activities. The total number of respondents for this variable are 183 responses. The mean score is 1.95, and the standard deviation is 1.02. The minimum and maximum values are 1 and 5, respectively.

Question eight: If I had a suggestion or identified a problem in the community, I would contact the council or my local councillor to inform them of my views. This variable was coded '5' for strongly agree, '4' for agree, '3' for neither agree nor disagree, '2' for disagree, '1' for strongly disagree and blank for those who didn't know (unanswered).

Approximately 56% of the respondents agreed that they would contact their local council or councillor if they had a problem. Approximately 23% of the respondents strongly agreed that they would contact their local council councillor if they had a problem. Also, about

13% of respondents neither agree nor disagree that they would contact their local council or councillor if they had a problem.

Approximately 6% of respondents disagreed that they would contact their local council or councillor if they had a problem. And finally, 4% of respondents strongly disagree that they would contact their local council or councillor if they had a problem. The total number of respondents for this variable are 175 responses. The mean response is 3.88, and the standard deviation is 0.96. The minimum and maximum values are 1 and 5, respectively.

Social Capital Indicator

To measure social capital, I used the eight questions described above to produce a social capital additive scale, where higher scores indicate higher social capital levels. To create the social capital indicator, I added the responses to each of the questions for each individual for the 168 individuals who answered these questions. I created an additive scale of these eight social capital variables. The way that the questions are coded suggest that someone reporting the lowest levels of that social capital on each variable could score as low as '7' on this scale while someone reporting the highest levels of social capital on each variable could score as high as '32'.

A total of 168 residents answered each of the eight questions used in this index. The mean of the social capital indicator is 17.54 (std. dev. = 5.58). The minimum and maximum values are 7 and 32, respectively. The alpha for the eight social capital items that make up the social capital indicator is 0.82. Thus, these variables appear to be a reliable indicator of the social capital indicator (e.g., this analysis). I now specifically hypothesize.

H5. As social capital indicator scores increase across Preston-New-Road residents, overall IES-R scores would also increase.

H6. As social capital indicator scores increase across Preston-New-Road residents, IES Avoidance scores would also increase.

H7. As social capital indicator scores increase across Preston-New-Road residents, IES Intrusion scores would also increase.

H8. As social capital indicator scores increase across Preston-New-Road residents, IES hyperarousal scores would also increase.

I first test these hypotheses using bi-variate analysis using Ordinary Least Squares (OLS) regression. The independent variable is the social capital indicator, and the dependent variables are IES-R, Avoidance, Intrusion and Hyper-Arousal subscales.

Table 7.2 Ordinary Least Squares Regression Coefficients (*b*) and Standard Errors (SE) for Social Capital predictors of IES-R

Stress	Overall IES-R		Avoidance		Intrusion		Hyperarousal	
	b	SE	*b*	SE	*b*	SE	*b*	SE
Social Capital Indicator	0.24	0.21	0.09	0.07	0.10	0.09	0.04	0.06
Constant	6.04	3.79	1.82	1.31	2.62	0.70	1.62	1.11
N	168		168		168		168	
Adjusted R^2	0.0021		0.0096		0.0017		-0.0028	

Note: ***p<0.001, **p<0.01, *p<0.05 significance (two-tailed).

According to Table 7.2, the overall IES-R scale is unrelated to stress. In particular, the social capital indicator is not significant (p >0.05). We, therefore, fail to reject the null hypothesis that there is no relationship between social capital and stress. As a result, hypothesis H5 that suggests as social capital indicator scores increase, overall IES-R score would also increase is not supported by these data.

According to Table 7.2, the social capital indicator's coefficient is not significant in the prediction of IES Avoidance. Again, we, therefore, fail to reject the null hypothesis. Thus, for hypothesis H6 there is little support that among Preston-New- Road residents as social

capital indicator scores increase, the IES Avoidance scores also increase. These same findings are true for the social capital indicator and the IES intrusion scale and the IES hyperarousal scale, which are also statistically insignificant. Thus, there is little support for hypothesis H7 and hypothesis H8. Overall, there is little support for the general hypothesis proposed in Chapter three that social capital is related to stress/distress.

The next section discusses the perception of recreancy variables and how they are combined to generate the perception of recreancy additive scale. It also discusses the use of OLS to analyse the perception of recreancy additive scale to test the hypotheses on the perception of recreancy and psychosocial stress.

7.5 Perception of Recreancy Index

Recall from chapter three that Freudenberg defined perception of recreancy as "behaviours of persons and/or of institutions that hold positions of trust, agency, responsibility, or fiduciary or other forms of broadly expected obligations to the collectivity, but that behave in a manner that fails to fulfil the obligations or merit the trust" (Freudenburg, 1993, p916-917). The perception of recreancy was measured using an index comprising of four questions from the PNR survey questionnaire. In this section, I describe each of those four questions and explain how each was coded. I provide descriptive statistics for each of the variables and then explain how they were used to compute a perception of recreancy indicator variable that can be used to test the relationship between perception of recreancy and fracking-related issues. The use of the single index reduces the problem of multicollinearity and degrees of freedom, and test the general hypothesis that increases perception of recreancy predicts increased stress/distress levels, as discussed in chapter three.

Question one: Cuadrilla understood my concerns or request. In this question, respondents were asked to rate whether they agreed or not with this statement. This variable was coded '1' for responses that strongly agree with this statement, '2' for responses that agree with this statement, '3' for responses that neither agree nor disagree with this statement, '4' for responses that disagree with this statement, '5' for responses that strongly disagree with this statement, and blank for blank answers.

Just about 35% of respondents strongly disagree that Cuadrilla understood their concerns or request. About 24% of respondents neither agree nor disagree that Cuadrilla understood their concerns or demands, and about 19% of respondents disagreed that Cuadrilla understood their concerns or request. Approximately 15% of respondents agree that Cuadrilla understood their concerns or demands, and just about 6% strongly agree that Cuadrilla understood their concerns or request. The total number of responses for this variable are 147, the mean score is 2.34, the standard deviation is 1.27, and the minimum and maximum values are 1 and 5, respectively.

Question two: Cuadrilla answered questions that I had. This question was coded '1' for responses that strongly agree with this statement, '2' for responses that agree with this statement, '3' for responses that neither agree nor disagree with this statement, '4' for responses that disagree with this statement, '5' for responses that strongly disagree with this statement, and blank for respondents who did not answer this question.

Just about 35% of respondents neither agree nor disagree that Cuadrilla answered questions they had. About 26% of respondents strongly disagree that Cuadrilla answered questions they had, and approximately 17% of respondents disagree that Cuadrilla answered questions they had. About 14% of respondents agree that Cuadrilla answered questions they had, and finally, about 8% strongly agree that Cuadrilla answered questions that they

had. The total responses for this question are 148, the mean response is 2.60, the standard deviation is 1.24, and the minimum and maximum responses are 1 and 5, respectively.

Question three: Cuadrilla treated me fairly. This question was coded '1' for responses that strongly agree with this statement, '2' for responses that agree with this statement, '3' for responses that neither agree nor disagree with this statement, '4' for responses that agree with this statement, and '5' for responses that strongly disagree with this statement, and blank for blank responses.

Approximately 32% of respondents neither agree nor disagree that Cuadrilla treated them fairly. Approximately 29% of respondents strongly disagree that Cuadrilla treated them fairly, and 19% of respondents disagree that Cuadrilla treated them fairly. Just about 11% agree that Cuadrilla treated them fairly, and finally, about 9% strongly agree that Cuadrilla treated them fairly.

The total number of responses for this variable are 142, the mean score is 2.53, the standard deviation is 1.27, and the minimum and maximum values are 1 and 5, respectively.

Question four: Cuadrilla resolved my concern or request. This question was coded '1' for responses that strongly agree with this statement, '2' for responses that agree with this statement, '3' for responses that neither agree nor disagree with this statement, '4' for responses that agree with this statement, and '5' for responses that strongly disagree with this statement, and blank for blank responses. Just about 40% of respondents neither agree nor disagree that Cuadrilla resolved their concerns or request.

About 30% strongly disagree that Cuadrilla resolved their concerns or request, and approximately 16% disagree that Cuadrilla resolved their concerns or request. About 7% agree that Cuadrilla resolved their concerns or request, and finally, about 6% strongly

agree that Cuadrilla resolved their concerns or request. The total number of responses for this variable are 141, the mean score of responses is 2.43, and the standard deviation is 1.18. The minimum and maximum values are 1 and 5, respectively.

Perception of Recreancy Indicator

To measure the perception of recreancy scales, I used the four questions described above to produce a perception of recreancy additive scale. To create this indicator, I added the individual responses to each of the four questions up for each individual for the 127 individuals that answered these questions. Thus, I created an additive scale of these four perceptions of recreancy variables.

The way that the questions are coded suggests that someone reporting the lowest level of perception of recreancy on each variable could score as low as '4' on this scale while someone reporting the highest level of perception of recreancy on each variable could score high as '20'. The total number of observations for the recreancy indicator is 127. This means that 127 residents answered each of the four questions used in this index. The mean of the perception of recreancy indicator is 14.06 (std. dev. = 4.51). The minimum and maximum values are 4 and 20, respectively.

I test the reliability of the recreancy scale in Stata and find that the four recreancy variables are internally consistent (alpha = 0.94). Thus, these variables appear to be a reliable indicator of the recreancy. As a result, I specifically hypothesize:

H9. As the perception of recreancy indicator scores increases across Preston-New-Road residents, overall IES-R scores would also increase.

H10. As the perception of recreancy indicator scores increases across Preston-New-Road residents, IES Avoidance scores would also increase.

H11. As the perception of recreancy indicator scores increases across Preston-New-Road residents, IES Intrusion scores would also increase.

H12. As the perception of recreancy indicator score increases across Preston-new-Road residents, IES Hyperarousal scores would also increase.

Again, I test these hypotheses using bi-variate analysis using Ordinary Least Squares (OLS) regression where the independent variable is the recreancy indicator, and the dependent variables are IES-R, Avoidance, Intrusion and Hyper-Arousal subscales.

Table 7.3. Ordinary Least Squares Regression Coefficients (*b*) and Standard Errors (SE) for Perception of Recreancy predictors of IES-R

Stress	Overall IES-R		Avoidance		Intrusion		Hyperarousal	
	b	SE	*b*	SE	*b*	SE	*b*	SE
Recreancy Indicator	1.62***	0.26	046***	0.09	0.74***	0.12	0.46***	0.08
Constant	-11.36	3.78	-2.81	1.33	-5.25	1.78	-3.33	1.15
N	127		127		127		127	
Adjusted R^2	0.237		0.164		0.223		0.190	

Note: ***p<0.001, **p<0.01, *p<0.05 significance (two-tailed).

From Table 7.3, a unit increase in the perception of recreancy indicator score is associated with a 1.62 unit increase in the IES-R score. This increase is significant (p>0.05). As a result, we reject the null hypothesis that there is no relationship between perception of recreancy and stress. As a result, hypothesis H5 that across Preston-New-Road residents, as the perception of recreancy indicator score increase, overall IES-R score would also increase is supported by these data.

Table 7.3 also suggests that perception of recreancy is related to each of the three IES-R subscales. For example, on the IES-Avoidance scale, a one-unit increase in perception of recreancy indicator score is associated with a 0.46 increase in the IES-Avoidance score (p<0.05). Therefore, we reject the null hypothesis that there is no relationship between the

perception of recreancy and avoidance stress and conclude that there is support for the hypothesis that across Preston-New-Road residents as the perception of recreancy indicator score increase (i.e., residents are less trusting) the IES-Avoidance score would also increase.

According to Table 7.3, on the IES-Intrusion scale, a one-unit increase in the perception of recreancy indicator score will increase the IES-Intrusion score by 0.74. The perception of the recreancy indicator is also statistically significant ($p<0.05$). Therefore, we reject the null hypothesis that there is no relationship between recreancy and intrusion stress on the IES-R scale. As a result, hypothesis H9 that across Preston-New-Road residents, as recreancy indicator score increase, overall IES-Intrusion score would also increase is supported by the data.

According to Table 7.3, on the IES-Hyperarousal scale, a unit increase in the perception of recreancy indicator score will increase the IES-Hyperarousal score by a factor of 0.43. The perception of recreancy indicator is significant. Therefore, we reject the null hypothesis that there is no relationship between recreancy and hyperarousal stress on the IES-R scale. As a result, hypothesis H10 that across Preston-New-Road residents, as the perception of recreancy indicator score increase, overall IES-Hyperarousal score would also increase is supported by the data.

Overall then the results for the perception of recreancy are consistent. This finding shows that the level of mistrust of the gas company, Cuadrilla Mining Resources, increases psychosocial stress in the Wesby and Wrea Green community. This result is discussed further in chapter nine.

7.6 Descriptive Statistics of Controlled Variables

While only the perception of recreancy scale was related to the IES-R and its subscales, it is important to control other variables that might impact that relationship. For that reason, I examined variables that may impact the relationship between perception of recreancy and IES-R. The following variables were controlled in the subsequent data analysis: Sex, Education, Race, Age, Income, Employment, Political Orientation, and Duration of residence. This section describes these controls and uses them to predict IES-R scores prior to examining them in a multivariate model with recreancy.

Sex: The variables ask: How do you identify yourself? This question was coded '0' for male, and '1' for female. Approximately 60% of respondents identified themselves as female, and just about 40% of residents identified themselves as male. A total of 181 respondents answered this question, and the mean response is 0.40 - meaning that 40 per cent of the sample is female. The standard deviation is 0.49.

Education: This variable asks: Which is your highest level of educational qualification? This question was coded '1' for no education, '2' for GCSE, '3' for Apprenticeship/A/AS levels, '4' for a higher level. Approximately 52% of respondents have attained higher levels of education. Just about 28% of respondents have Apprenticeship/A/AS level of education. About 10% of respondents have GCSE, and only about 10% also have no education. The median score is 4, and this implies the median education level is the higher level.

Race: This variable asks: How do you identify yourself? This question was coded '1' for native British/white, and '0' for black/African Americans. Approximately 99% of respondents are native British/white, and just about 1% are blacks/African America.

Age: This variable asks: Please indicate your age bracket. This question was coded '1' for respondents below 18 years old, '2' for respondents between 18 – 24 years old, '3' for respondents between 25 – 34 years old, '4' for respondents between 35 – 44 years old, '5' for respondents between 45 – 54 years old, '6' for respondents between 55 – 64 years old, '7' for respondents between 65 – 74 years old, '8' for respondents between the ages of 75 – 84, and '9' for respondents older than 84 years old.

Just about 29% of respondents are aged between 65 and 74, and approximately 26% of respondents are aged 55-64 years old. About 19% of respondents are aged 45-54 years old, and about 11% are aged 75-84 years old. Approximately 8% of the respondents are aged 35-44 years old, just about 4% are aged 25-34 years old, around 2% are aged above 85 years old, and approximately1% are aged 18-24 years old. The total number of respondents for this variable is 181, and the median score is 6 (55-64 years). The minimum and maximum values reported by the 181 respondents are 2 (18 to 24years) and 9 (older than 84years) respectively.

Income: This variable asks: Please indicate your approximate weekly household income bracket. This question was coded '1' for households with a weekly income of up to £599, '2' for households with a weekly income of between £600 - £1,249, '3' for households with a weekly income of between £1,250 - £1,999, '4' for households with a weekly income of £2,000 – £2,999, '5' for households with a weekly income of £3,000 - £3,999, and '6' for households with a weekly income of £4,000, and above. Approximately 28% of the respondent's household weekly income is up to £599, and approximately 25% of the respondent's household weekly income is between £600 - £1249.

Just about 22% of respondents' household weekly income is £1250 - £1999, and 14% of respondent's households weekly income is £2000 - £2999. Approximately 8% of

respondents have a weekly household income of $4000 and above, and Approximately 4% of respondents have a weekly household income of between £3000 - £3999. Only 138 respondents answered this question on income.

Employment: This question asks: Employment status: Are you currently.....? This question was coded '1' for employed, and '0' for unemployed. Approximately 51% of the respondents are employed, and just about 49% are unemployed.

Political Orientation: This variable asks: What is your political orientation? This question was coded '1' for Conservative and '0' for Labour. Approximately 56% of respondents are Conservatives, and just about 44% are Labour.

Duration of residence: This question asks: How long have you lived in this community? This question asked respondents to indicate how long (in years) they have lived in the community. Responses were entered in actual and not coded. The total number of respondents for this question was 182, and the mean or the average number of years respondents have lived in the community is 25.24 years, the standard deviation is 17.90, and the minimum and maximum values are 1 year, and the maximum any resident has live in the community is 85 years.

Finally, I test the significance of these controlled variables using bi-variate analysis using Ordinary Least Squares (OLS) regression. The independent variables are the controlled variables, and the dependent variables are IES-R, Avoidance, Intrusion and Hyper-Arousal subscales.

Table 7.4 Ordinary Least Squares Regression Coefficients (*b*) and Standard Errors (SE) for Independent variables of IES-R scale

Stress	Overall IES-R		Avoidance		Intrusion		Hyperarousal	
	b	SE	*b*	SE	*b*	SE	*b*	SE
Sex	8.71***	2.61	2.76**	0.86	3.64*	1.25	2.29*	0.79
Education	0.88	1.41	0.87	0.47	0.22	0.68	-0.21	0.43
Race	-3.24	13.80	-3.69	4.57	-0.76	6.61	1.21	4.20
Age	3.02**	1.20	1.34***	0.40	1.12	0.57	0.56	0.34
Income	-0.26	0.85	-0.39	0.28	0.16	0.41	-0.03	0.26
Employment	4.19	3.14	1.56	1.04	1.56	1.50	1.06	0.96
Political Orientation	-3.27	2.44	-0.36	0.81	-1.93	1.17	-0.99	0.74
Duration of Residence	-0.05	0.07	-0.03	0.02	-0.004	0.03	-0.01	0.02
Constant	-9.47	3.82	-3.67	5.93	-3.69	8.59	-2.10	5.46
N	125		125		125		125	
Adjusted R^2	0.0716		0.1084		0.0431		0.0425	

Note: ***p<0.001, **p<0.01, *p<0.05 significance (two-tailed).

Table 7.4 shows that the sex and age variables are the two significant controlled variables on the overall IES-R scale. The other variables education, race, income, employment, political orientation, and duration of residence are not significant. The sex and age variables are not only statistically significant but also meaningful. For example, on average, females score 8.71 points higher on the IES-R than male.

For the IES-Avoidance scale, sex and age are the only significant variable. For the sex variable, the mean difference between male and female score is 2.76, i.e., females are more stressed than males and have an average score that is 2.76 points higher than males. The mean IES-Avoidance score for the male is 3.67, and the mean IES-Avoidance score for the female is 6.43. For the age variable, moving from one age category to the next is associated with an IES-Avoidance score that is 1.34 points higher.

On the IES-Intrusion scale, sex is the only significant variable. The mean difference between male and female scores on the IES-Avoidance scale is 3.64. Thus, Females are more stressed by 3.64 points on the IES-Avoidance scale than male ($p<0.05$).

Likewise, on the IES-Hyperarousal scale, sex is the only significant variable. The mean difference between male and female scores on the IES-Hyperarousal scale is 2.29. Again,

females are more stressed than males on the IES-Hyperarousal scale and score 2.29 more points on that scale than males.

7.7 Test of Significance of Combined Variables

To examine the impacts of social capital, community attachment, perception of recreancy, and the two significant control variables (i.e., age, and sex) on IES-R (IES-R, Avoidance, Intrusion, and Hyperarousal scales), I used multivariate OLS regression. The results are presented in Table 7.5.

Table 7.5 Ordinary Least Squares Regression Coefficients (*b*) and Standard Errors (SE) for Social Capital indicators, Community Attachment indicators, Recreancy, Age, and Sex of IES-R

Stress	Overall IES-R		Avoidance		Intrusion		Hyperarousal	
	b	SE	*b*	SE	*b*	SE	*b*	SE
Social Capital	0.32	0.24	0.10	0.08	0.11	0.11	0.10	0.07
Recreancy	1.84***	0.28	0.53***	0.10	0.84***	0.13	0.47***	0.09
Community Attachment	-0.38	0.66	-0.04	0.23	-0.11	0.31	-0.23	0.20
Age	4.54***	2.56	0.97**	0.34	1.15**	0.46	0.60*	0.30
Sex	2.72	0.97	1.78*	0.90	1.89	1.22	0.88	0.79
Constant	-35.50	8.81	-11.86	3.10	-15.54	4.20	-7.99	2.7
N	119		119		119		119	
Adjusted R^2	0.2521		0.2141		0.2421		- 0.1977	

Note: ***p<0.001, **p<0.01, *p<0.05 significance (two-tailed)

From Table 7.5, on the overall IES-R scale, the social capital indicative scale is unrelated to stress; that is, it is not significant. The perception of recreancy indicator is significant ($p<0.05$). When the perception of recreancy indicator scale is zero, the overall IES-R score is -35.5. A unit increase in perception of recreancy is associated with a 1.84 unit increase in the overall IES-R score. The community attachment indicator scale is unrelated to stress, and it is, therefore, not significant. The age variable is significant ($p<0.05$). The overall IES-R score is -35.50 when age is zero, and a unit increase in age corresponds to a rise of stress by a factor of 4.54. The higher the age, the higher the stress. The gender variable (measured by the variable sex) is unrelated to stress, and it is not significant.

From Table 7.5 n the IES-Avoidance scale, the social capital indicator scale is unrelated to stress, and therefore not significant. The perception of recreancy scale is significant ($p<0.05$). When the perception of recreancy score is zero, the IES-Avoidance score is -11.86. A unit increase in perception of recreancy score is associated with a 0.53 unit increase in the IES-Avoidance score.

The community attachment indicator scale is unrelated to stress, and therefore not significant. The age variable is significant, and when age is zero, the IES-Avoidance is -11.86. A unit increase in age will correspond to an increase of IES-Avoidance stress by a factor of 0.97. The sex variable is also significant. Females have an average IES-Avoidance score of 1.78 units higher than males. Males have a mean IES-Avoidance score of 11.86, and that of females is 13.64.

From Table 7.5 on the IES-Intrusion scale, the social capital indicator scale is unrelated to stress, and therefore not significant. The perception of recreancy indicator scale is significant. When the perception of recreancy indicator score is zero, the overall IES-Intrusion score is -15.54. A unit increase in perception of recreancy indicator score is associated with a 0.84 unit increase in the IESR-Intrusion score. The community attachment indicator scale is unrelated to stress and therefore, not significant.
The age variable is significant, and when age is zero, the IESR-Intrusion scale score is -15.54. A unit increase in age will correspond to an increase of IESR-Intrusion stress by a factor of 1.15. The sex variable is unrelated to IES-R-Intrusion stress, and therefore not significant.

Finally, from Table 7.5 on the IES-R-Hyperarousal scale, the social capital indicator scale is not significant and unrelated to IES-R-Hyperarousal stress. The perception of recreancy indicator scale is significant. When the perception of recreancy indicator scale score is

zero, the IES-R-Hyperarousal score is -7.99. A unit increase in the perception of recreancy indicator scale score corresponds to a 0.47unit increase in IES-R-Hyperarousal score.

The community attachment indicator scale is not significant and unrelated to IES-R-Hyperarousal stress. The age variable is significant and related to IES-R-Hyperarousal stress. When age is zero, the IES-R-Hyperarousal scale score is -7.99, and a unit increase in age will correspond to an increase of IES-R-Hyperarousal stress by a factor of 0.60. The sex variable is not significant and unrelated to IES-R-Hyperarousal stress.

Table 7.6 below summarizes the tests of the hypothesis and their level of significance. Section 7.9 discusses further the meaning of the results above, and section 7.10 summarizes this chapter.

7.8 Summary of Tests of Hypotheses

Hypotheses		Results
Community Attachment		
H1	Across Preston New Road residents, as community attachment indicator scores increase, overall IES-R scores will also increase	Insignificant
H2	Across Preston New Road residents, as community attachment indicator scores increase, overall IES-Avoidance scores will also increase	Insignificant
H3	Across Preston New Road residents, as community attachment indicator scores increase, overall IES-Intrusion scores will also increase.	Insignificant
H4	Across Preston New Road residents, as community attachment indicator scores increase, overall IES-Hyperarousal scores will also increase.	Insignificant
Social Capital		
H5	Across New Preston Road residents, as social capital indicator scores increase, overall IES-R scores will also increase.	Insignificant
H6	Across New Preston Road residents, as social capital indicator scores increase, IES Avoidance scores will also increase.	Insignificant
H7	Across New Preston Road residents, as social capital indicator scores increase, IES Intrusion scores will also increase.	Insignificant
H8	Across New Preston Road residents, as social capital indicator scores increase, IES hyperarousal scores will also increase.	Insignificant
Perception of Recreancy		
H9	Across Preston New Road residents, as recreancy indicator scores increase, overall IES-R scores will also increase	Significant
H10	Across Preston New Road residents, as recreancy indicator scores increase, IES Avoidance scores will also increase	Significant
H11	Across Preston New Road residents, as recreancy indicator scores increase, IES Intrusion scores will also increase	Significant
H12	Across Preston New Road residents, as recreancy indicator score increase, IES Hyperarousal scores will also increase.	Significant

Table 7.6: Summary of the significance of the research hypothesis

7.9 Further Explanation of Perception of Recreancy Variable

The perception of recreancy variable in this thesis is about the mining company Cuadrilla Mining Resources. The findings indicate that the level of mistrust of Cuadrilla increases with the psychosocial stress level. This finding is consistent with what respondents said about trust in the survey questionnaire. For instance, respondent SI010 said:

> Cuadrilla have the nerve to ask our views about the use of the community fund (what an insult to be offered less than £200 per household) when over £100,000 has been lost from the value of our house. There is no trust in Cuadrilla. They fail to report the drilling relating to the earthquake at the beginning, and there is huge concern over the safety e) the potential unknown impact on the health of local residents is hugely worrying. (Respondent SI010, 2018).

Another respondent SI026 said most people he has talked to do not trust the developer (Cuadrilla) would adhere to their terms of reference regarding fracking. He said that

> You might ask further about trust and community, e.g. were you asked to trust that the developer would act responsibly and adhere to all applicable legislation and planning application? I know this is a big issue in community circles. Most community members I talk to, do not trust the developer to act responsibly despite government assurance. Cuadrilla at Preston New Road broke planning regulation at the first opportunity by bringing in drilling equipment during the night citing security and less disruption. Rightly or wrongly, the community will view this as the developer breaking this agreement with impunity, and with little regard for either regulation or people feelings or wellbeing (Respondent SI026, 2018).

Respondent SI039 has a son who is sensitive to noise and contacted Cuadrilla. However, she did not receive the needed help, and she expressed her disappointment with the fracking process and called the entire process a “disgrace”. She said that:

> We have an autistic son who is sensitive to noise. The drills are about 750 yards from our house. We have contacted Cuadrilla, the council of our MP. Our MP and Cuadrilla are a waste of time, and our council listened but got overturned when they turn planning down. The whole scenario is a disgrace. Cuadrilla monitors themselves very badly. (Respondent SI039, 2018)

The mining company's mistrust is a significant finding in this research, and the OLS regression analysis correlates with what the respondents said. Respondents seem to trust their local council more than the gas company. This will be discussed further in chapter eight. The next section is the chapter summary.

7.10 Chapter Summary

This chapter is the multivariate analysis chapter. It answers research question three: “Do the sociological concept of community attachment, perception of recreancy, and social capital help explain the variation in fracking-related stress in the Preston community?”.

I formed the community attachment indicative scale with eight variables from the administered survey questions, the perception of recreancy indicative scale with four survey questions, and the social capital indicative scale with two survey questions. I used bi-variate analysis to check the significance of these three indicative scales. The perception of recreancy indicative scale was significant with the IES-R scales, intrusion subscales, avoidance subscales, and the hyperarousal subscales. These findings indicate that as perception of recreancy increases, stress related to hydraulic fracturing would also increase.

The next chapter is the conclusion and policy recommendation chapter. The chapter gives an overview of the research questions and how it was answered. The theoretical and practical implication of the thesis is also discussed. Suggestion on how to better manage natural resources, in this case, gas extraction, is proposed. Finally, a recommendation of an alternative to fracking is discussed.

8.0 CHAPTER EIGHT: CONCLUSION AND POLICY RECOMMENDATION.

8.1 Introduction

This is the conclusion and policy recommendation chapter, and it is divided into two parts. Part one provides an overview of my research questions and findings. It examines the weakness of the thesis and how to improve upon this in future research. The theoretical and practical implication of this research is also highlighted.

Part two discusses the factors that have influenced perception of fracking in the Preston-New-Road site and suggest ways to manage future hydraulic fracturing sites to ensure sustainability, equity, and, more importantly, reduced psychosocial stress. Part two also maps out the implications of this research for other areas such as environmental justice and discusses fracking's ethical perspective. It ends by suggesting an alternative to shale gas extraction by hydraulic fracturing techniques in England.

PART ONE

8.1.1 Overview of Research Questions.

This thesis sought to determine the psychosocial impact of hydraulic fracturing in Lancashire using the IES-R. As stated in chapter one, no research has been done in the UK on the community impacts of fracking concerning its social impacts in the form of psychosocial stress and community disruption, and cohesion. To achieve the goal of this research, three research questions were proposed. Research question one asks, is there theoretical justification for applying the IES-R literature to hydraulic fracturing? Research question two asks, do residents in the Preston community report that hydraulic fracturing is linked to stress, measured by the IES-R? Research question three asks, do the sociological

concepts of community attachment, perception of recreancy, and social capital explain the variation in fracking-related stress in the Preston-New-Road community?

Research question one was answered in Chapter Four. Chapter Four examined the IES-R, its origin, significance, and application. It was found that the IES and IESR-R have been used in numerous studies with a variety of adult populations, for example, combat veterans (Bonnie et al., 1990), victims of assault (Elliott & Briere, 1995), survivors of motor vehicle accidents (Bryant & Harvey, 1996), survivors of disasters at sea (Dalgleish et al., 1996), and survivors of a natural disaster (Johnsen et al., 1997).

The IES has also been used in clinical outcome work to assess the effectiveness of drug trials (Davidson et al., 1991), relaxation training (Hossack & Bentall, 1996), treatment programs (Richards et al., 1994), time-limited psychotherapy (Ford et al., 1997), and Eye Movement Desensitization and Reprocessing (Grainger et al., 1997). It has proved valuable in documenting the course of posttraumatic phenomena over time (Rothbaum et al., 1992). Also, the IES has been used with children and adolescents (Green et al., 1994) and has been described as probably the best questionnaire for evaluating childhood PTSD (McNally, 1996). As this thesis demonstrates, the IES-R appears to also be a valid instrument used to measure psychosocial stress in Lancashire.

Research question two was answered in chapter six. In chapter six, the survey results from the IES-R were analysed. The mean of the total IES-R scale, Intrusion scale, Avoidance scale, and Hyperarousal scale were analysed. Recall that the intrusion scale measures thoughts or feelings about a traumatic event arising without conscious effort, the avoidance scale measures deliberate efforts to avoid thinking or talking about a traumatic event, and the hyperarousal scale measures an exaggerated startle response, angry outbursts, hypervigilance. The results show that some residents did seem to be stressed by

hydraulic fracturing in their community. On the total IES-R scale, 7% of respondents reported some significant clinical concerns which can be detrimental when not treated.

Research question three was answered in chapter seven. Chapter tree found that the three main concepts that may help explain the variation in hydraulic fracturing related stress among residents in the PNR community are community attachment, perception of recreancy, and social capital. Multi-variate regression analysis using STATA 13 was run using indicative scales of these three variables with the stress scales, IES-R, Intrusion, Avoidance, and Hyperarousal, as the dependent variable.

It was found that only the perception of recreancy was statistically significant. It was concluded that, as the perception of recreancy increases, stress related to hydraulic fracturing also increases. Recall, that perception of recreancy measures the level of mistrust of institutions. This perception of recreancy variable asked respondents whether they trust the mining company, Cuadrilla Mining Resources or not.

The three research questions were, therefore, adequately answered in this thesis. This fulfils the core mandate of the thesis. The next section will discuss the findings of this research.

8.1.2 Findings of the Research

a) The revised impact of event scale is a useful instrument used to study posttraumatic stress in natural extraction resource communities. Few studies have used the IES-R in natural resource extraction, and this finding expands the literature in that direction. No research has used the IES-R to measure psychosocial stress induced by hydraulic fracturing. This is an essential finding of this research.

b) There is evidence that psychosocial stress is indeed associated with hydraulic fracturing extraction. The findings indicate that residents living near the Preston-New-Road extraction site exhibited a level of psychosocial stress. The literature states that residents in close proximity exhibit psychosocial stress. This finding expands the literature in this regard.

c) Increased perceptions of recreancy increase stress in natural resource extraction communities. In particular, perception of recreancy was highly significant with the IES-R score and its subscales, i.e., intrusion subscale, avoidance subscale, and hyperarousal subscale.

8.1.3 Theoretical and Policy Implication of this Thesis.

Theoretical Implication

As discussed in chapter three, an increasing body of research suggests that a perceived or real threat to the natural world can increase distress. Some perceived threat to the natural world includes oil spills, earthquakes, tremors, pollution, and chemical releases. Recently, in the UK, a study by Gidlow et al. (2016) suggests that there is support that residence in more natural areas might have stress-reducing effects. This growing body of literature examines the psychological stress that environmental hazards can have on nearby residents. A number of these researchers have found that oil and gas spills can lead to depression, anxiety, event-related psychological stress and post-traumatic stress disorder (Baxendale, 1996; Green et al., 1990; Green et al., 1994; Guest et al., 2018; Johnsen et al., 1997; King et al., 2009; Picou et al., 1992; Rothbaum et al., 1992). Regarding shale gas extraction, no study has looked extensively at hydraulic fracturing and its potential impacts on UK residents' distress. This research fills this gap and serves as a framework for future studies on hydraulic fracturing and stress in the UK and other countries.

IES is one of the widely used measures of PTSD symptoms. As stated in section 4.3.1 of chapter four, the IES has been used extensively in several studies. Green et al. (1994) used the IES to study race difference in response to combat stress, Elliott & Briere (1995) used it to study the posttraumatic stress associated with delayed recall of sexual abuse, Bryant & Harvey (1996) used it to study the initial posttraumatic stress responses following motor vehicle accidents in 114 motor vehicle accidents victims within two weeks of hospital admission, Dalgleish et al. (1996) used the IES to study posttraumatic stress among survivors of disasters at sea, Johnsen et al. (1997) used IES to study posttraumatic stress symptoms in non-exposed, victims, and spontaneous rescuers after an avalanche, Picou et al. (1992) used IES to study the disruption and stress in an Alaskan Fishing Community after the famous Exxon Valdez Oil Spill, and Gill et al. (2014) similarly used the IES to compare psychosocial stress of the Exxon and BP oil spills.

The use of the IES and IES-R in natural resource extraction is very limited, and this research expands the literature in this regard. This research confirms that the IES and IES-R are useful tools that can be used to measure PTSD in hydraulic fracturing communities and by extension, PTSD in other resource extraction activities. Thus, the researcher recommends using IES to study stress related to loss of natural resources such as forest and biodiversity, soil, air pollution, and land, including all minerals, vegetations, crops.

Policy and Practical Implications

Perception of recreancy or mistrust of the mining company is the significant findings of this thesis. Respondents expressed their mistrust of the mining company. This was positively related to increased intrusion stress, avoidance stress, and hyperarousal stress (as shown in chapter seven). One of the respondents coded SI010 stated that “There is no trust in Cuadrilla. They fail to report the drilling relating to the earthquake at the beginning, and

there is huge concern over the safety". The residents were not satisfied with the gas company's disclosure level, which affected the level of trust between the residents and the gas company.

Another issue of mistrust raised by the respondents is central government mistrust. Although the local council in Lancashire voted against hydraulic fracturing, their votes were over-turn by the central government. This paved the way for hydraulic fracturing in the PNR site. Respondent SI045 stated that:

> Cuadrilla were refused planning by the local council, so that should have been its end. The government overruled this, which makes me annoyed. What has happened to democracy and freedom of speech, something my late family fought for, over the years". (Respondent SI045, 2018)

From the discussions above, I proposed that to deal with the psychosocial stress associated with hydraulic fracturing or other mining activities, policymakers should consider the issue of trust. Measures should be put in place to ensure residents will have absolute trust in the mining company.

The local council in Lancashire also seems to enjoy an adequate level of trust by the local residents. To deal with psychosocial stress, the decision of whether or not to frack should be in the hands of the local council and their representatives.

Finally, I proposed a model that should be adhered to in dealing with the psychosocial stress associated with hydraulic fracturing and other unconventional shale gas exploration.

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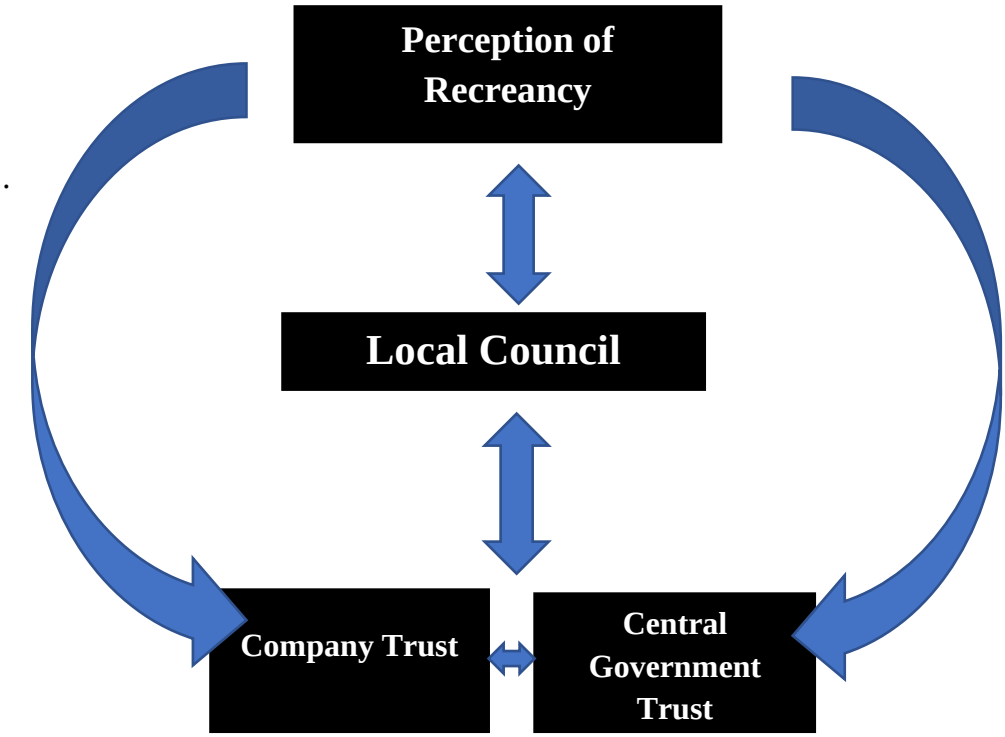

Figure 8.1: Proposed Perception of Recreancy Model

From Figure 8.1 above. I proposed that in coping with psychosocial stress related to shale gas extractions, policymakers should deal with the perception of recreancy. Efforts should be made to ensure residents trust the mining company and the central government. At the heart of the perception of recreancy should be the local council. Residents trust the local council and their approval will ease tension and stress.

8.1.4 Limitations and Future Prospects

There are some limitations of this study that need to be considered. First, from chapter one, it was found that there are about ten potential hydraulic fracturing sites in the UK. However, only the PNR in Lancashire has been developed, and the green light has been given by the UK government for full-scale exploratory fracking to commence; the reason this site was selected as project site in this thesis. Therefore, it is recommended that future research consider longitudinal studies that will include other fracking sites in the UK.

Second, from Chapter Seven, the perception of recreancy indicative scale only measured perception of recreancy based on how respondents think about the gas company, Cuadrilla Mining Resources. The perception of recreancy questions asked in the survey questionnaire is 1. Cuadrilla understood my concerns or request; 2. Cuadrilla answered questions that I had; 3. Cuadrilla treated me fairly, and 4; Cuadrilla resolved my concern or request. Future research should include in the perception of recreancy variables specific questions about the local council, the government, and other state agencies. This will enable respondents to address their concerns to the right agency specifically.

Third, it is the researcher's view that different types of trust should be examined, not just trusted associated with mining (oil and gas) companies. Some residents express their disappointment about how the government handles the fracking process in the PNR community. For instance, respondent SI003 said

> Despite the local community/council rejecting applications etc. re-fracking. The government forged ahead – complete disregard for the local community. This is purely about money. I don't believe that a Labour Government will halt fracking despite saying so. Why was the area chosen for fracking, due to being on Blackpool's doorstep – already an area of deprivation and serious health inequalities? (Respondent SI003, 2018).

Another resident also expressed her disapproval of governmental involvement when she stated that "I think fracking in Lancashire is a complete disgrace. The community voted against it, yet the government went ahead. It has caused a lot of disruption and divides in this community". Thus, the issue of government trust should also be given the necessary attention in future research. Questions that might be asked on future surveys include:

i. I trust the Lancashire County Council to do what is best for my community.
ii. I trust the central government to protect my community from adverse effects of hydraulic fracturing.

Fourth, future research should examine the fracking approval process in PNR and other future fracking sites. Some residents were concern about the undemocratic process used in approving fracking in PNR. The local council in Lancashire voted to disapprove fracking in PNR. However, the central government overturned this decision. The residents feel betrayed because their views have been over-looked. For instance, respondent SI115 said:

> Lancashire voted against fracking. Theresa May's government overruled this decision to allow it to go ahead. Lancashire is being treated as an experiment. Cuadrilla regularly breaks the rules laid out by the government, i.e. traffic, tankers, and other vehicles driving on-site at night and early morning. Taking wastewater off-site in rusty leaking skips, constant noise 24 hours a day and night, pollution all night. Cuadrilla and other fracking companies should not be allowed to pollute our beautiful island. Wind, solar, and ocean energy are all more suitable and sustainable and are plentiful. (Respondent SI115, 2018).

Another respondent SI085 also stated that

> The application to extract shale gas has been refused on two separate occasions on the grounds of the road network is 'not fit for purpose'. The secretary of state overruled the decision at the last public inquiry held at Blackpool F.C. in 2016. We may just as well throw away the high safety - good vehicle 'o' licence registration etc. I am the expert transport consultant who presented evidence at all inquiries to date and will make our case in 2018 at Blackpool. (Respondent SI085, 2018)

Lastly, this research funding was limited, as was the time frame for data collection. Considering these factor I did an excellent job with this research.

PART TWO

This section discusses the factors that have influence the perception of fracking in the Preston-New-Road site and suggest ways to manage future hydraulic fracturing sites better to ensure sustainability, equity, and reduced psychosocial stress. It ends by mapping out

the implications of this research for other areas such as environmental justice. Finally, this part suggests alternatives to shale gas extraction by hydraulic fracturing techniques.

8.2.1 Factors that Influence the Perception of Impacts of Hydraulic Fracturing

Unconventional natural gas extraction using fracking techniques is an emerging technology in the UK and the world. Because of this, the total impacts of full-scale fracking are not known. The public has formed numerous perceptions of this new and emerging technology's environmental, health, and social impacts. This section focuses on the factors that influence public perception of fracking.

A 2013 survey by Boudet et al. (2014) on the perception of fracking in the US yielded the following results; 58% of those interviewed were undecided, 20% opposed hydraulic fracturing in the US, and 22% supported hydraulic fracturing. Research on factors that influence perception has been mainly based on socio-demographic variables; affective imagery; geographic location; political ideology; media; and familiarity (Besley, 2010; Leiserowitz, 2006; Scheufele & Lewenstein, 2005; Visschers & Siegrist, 2013).

Socio-Demographic Factors

There have been numerous studies on the relationship between socio-demographic variables and opposition and support for emerging technologies (Brossard et al., 2009; Cobb, 2005; Cobb & Macoubrie, 2004; Coleman, 1993; Ho et al., 2013). Studies by Siegrist et al. (2007) found that women generally have higher risk perception levels and are more likely to reject emerging technologies. Further studies also suggest that ethnic minorities are less supportive of wind power, coal, and natural gas plants (Ansolabehere & Konisky, 2009). The relationship between support for emerging technologies and education, age and income level are less consistent (Boudet et al., 2014). However, Firestone & Kempton (2007) found that the elderly generally tend to support wind power.

Those with higher incomes and qualifications are also likely to oppose natural gas siting (Jacquet, 2012), but tend to support wind power (Firestone & Kempton, 2007).

Affective Imagery

Affective imagery and risk and benefit perception among individuals are often important indicators of acceptance of emerging technology. Accessing risks and benefits always affects individuals' approval or rejection of an energy regime (Pidgeon & Demski, 2013; Visschers & Siegrist, 2013). Specific risks and benefits include economic impacts such as the cost of electricity, job creation; environmental impacts such as wildlife and landscape damage; and aesthetic impacts such as visible features (e.g. wind turbines) (Devine-Wright, 2005; Firestone & Kempton, 2007).

Affect is defined as "the specific quality of 'goodness' or 'badness' experienced as a feeling state (with or without conscious awareness) or the positive or negative quality of a stimulus" (Leiserowitz, 2006, p. 1436). Affect aids fundamental direct processes regarding memory and information processing (Slovic et al., 2005). Lee et al. (2005) suggest that information that is easily recalled is more likely to make decisions than information requiring deep and intense mental work. Affective imagery is "broadly constructed to include sights, sounds, smell, ideas, and words, to which positive and negative affect or feeling states have become attached through leaving and experience (Slovic et al., 2005, p 3). According to Leiserowitz (2005), one of the reasons people do not pay much attention to climate change is that climate change evokes the perception of a distant event such as the melting of glaciers.

Research by Keller et al. (2012) on the acceptance or opposition to replacing old nuclear reactors with new reactor technology concluded that most Swiss citizens associate nuclear power with negative imagery such as radioactivity, accidents and military use. This

negative imagery has made a portion of the population reject this new technology. Those who accepted the replacement of the ageing nuclear power also had positive affective imagery such as energy generation and the plant's nice visual appearance. This affective imagery and the risks and benefits associated with fracking may be an essential factor that determines whether individuals accept or reject fracking.

Geographic Location

How close an individual live to an extraction site is another factor that influences perceptions of fracking. Scholars have undertaken substantial work on how the proximity of natural gas extraction sites to households affects peoples' decision to accept or oppose the establishment of gas wells (Braunholtz, 2013; Johansson & Laike, 2007; Swofford & Slattery, 2010). A common term used for the opposition to hazards close to one's residence is ''Not in My Backyard'' (NIMBY). The NIMBY perspective suggests that the proximity of residents to an extraction site is associated with strong opposition to its establishment. However, in the case of extraction, those who live in close proximity to the site sometimes support the industry (Measham et al., 2016). This is not always the case, as there have been circumstances where those who live near extraction sites have opposed the industry (Devine-Wright, 2005).

Research conducted by Jacquet (2012) on North Pennsylvania residents' perception of wind turbine and gas wells sitting indicated that residents living in close proximity to the wind turbine supported the wind turbine's establishment. However, he did not find any relationship between distance and attitude towards the gas wells. The Pew Research Center for the People and the Press (2012) found no correlation between natural gas wells' opposition to the wells' proximity.

These findings have led various scholars to propose that the notion of geographical proximity is less important than issues such as psychological and emotional attachment to a particular place (Boudet et al., 2014). For instance, Devine-Wright (2005) research on wind farm development found that residents were more concerned about the effects that the turbine (whether onshore or offshore) will have on the landscape. Their main concern was that the turbine might negatively impact the aesthetic value of the landscape.

Political Ideology

Research has shown that an individual's political orientations significantly impact support or opposition to risky technology (Rothman & Lichter, 1987; Wildavsky & Dake, 1990). Political ideology may be of particular importance in energy and environmental issues in which partisan divisions colour much of the debate (Kamieniecki, 1995; Smith, 2002). For instance, a national survey on energy development by the Pew Research Center for the People and the Press (2012) found that conservatism is a strong predictor of support for fossil fuel development.

Media

Risk communication research suggests that media coverage may affect risk perception and acceptance of new technologies by serving as an essential agenda-setting function by determining what is newsworthy (Flynn et al., 1994; McCombs & Shaw, 1972). However, the magnitude and significance of agenda-setting by the media are dependent on medium, message and viewer (Boudet et al., 2014).

In terms of medium, scholars have suggested that television coverage of the information is more emotional and less in-depth and is aligned towards individual situations and episodes. However, newspapers provide more information and analysis and are orientated towards wider audiences because it covers broader themes (Driedger, 2007; Iyengar, 1991). Fewer

studies have examined the use of the internet and radio in public acceptance of new technologies. However, Krimsky (2007) suggested that because of the speed and accessibility of the internet, the potential for advocacy on the internet is greater than other channels of communication.

Analysis of newspaper coverage of fracking operations has been largely negative and focused on environmental issues, particularly water quality impacts (Davis & Hoffer, 2012; Evensen et al., 2014). However, comparisons of online and print coverage of fracking and new technologies have found online coverage to be more varied and environmentally themed (Cacciatore et al., 2012). It has also been criticised as "more biased and less comprehensive" (Gerhards & Schäfer, 2010, p.23).

Any effects of coverage on fracking perceptions are dependent on audience characteristics such as motivation for engaging with the information presented. To this effect, people with an already strong view of fracking will seek out media sources and information that reaffirm this viewpoint. This scenario is consistent with research on selective exposure (Stroud, 2008; Williams, 2011).

Familiarity

In general, risks that are perceived to be unknown give rise to opposition (Slovic, 1987); therefore, it is expected that limited familiarity with fracking will correlate with opposition. However, given the negative coverage that fracking has received in the media, it is likely that those who are more familiar will oppose it. A recent study by Brooks (2013) confirms that more familiarity with fracking leads to opposition.

8.2.2 Environmental Justice Implication of this research

The general notion and research support this thesis's findings that fracking operations induce psychosocial stress, and that residents living near extraction sites are stressed. Downey & Van Willigen (2005) found that given the widespread belief that industrial activity is noxious and threatening, and that residential proximity to such activity is highly undesirable, it is reasonable to expect that many people find residential proximity to industrial activity to be chronically stressful and, therefore, psychologically distressing. Residential proximity to industrial activity is also likely to increase individual feelings of personal powerlessness, further increasing distress. Powerlessness is a learned expectation that life outcomes result from forces external to oneself (Mirowsky & Ross, 1986; Seeman, 1959). Powerlessness develops as individuals learn to expect that their actions will not lead to desired outcomes due to repeated exposure to situations over which they have little control (Geis & Ross, 1998).

There is reason to expect that living near industrial facilities may expose individuals to such situations. Industrial and governmental decision-makers are often anonymous or distant figures who have few ties to local communities. Moreover, decisions about safe pollution levels, pollution mitigation, and economic development are usually made with little or no consultation with local communities. Sometimes, such decisions are made in the face of significant community resistance (Bullard, 1997b; Hofrichter, 1993). Furthermore, individuals who live in industrial communities may lack the resources to escape such communities.

Continued exposure to harmful effects of industrial activities has also been linked theoretically and empirically to feelings of fear and powerlessness in prior research, (Geis & Ross, 1998; Seligman, 1975; Taylor & Shumaker, 1990). Feelings of personal

powerlessness are a significant predictor of psychological distress (Mirowsky & Ross, 1986; Seeman, 1959). Thus, it is likely that feelings of powerlessness partially mediate the impact of residential proximity to industrial activity on psychological distress.

Proximity and Environmental Justice

Although fracking site selection is determined primarily by a geographical pattern of shale resources, some areas' prioritisation as extraction site involves an element of normative political judgment (Cotton, 2017). Notable in this regard was Lord Howell's[25] comment in the House of Lords in August 2013, where he stated; shale gas is suitable for "desolate" regions that he described as "unloved places that are not environmentally sensitive", specifically mentioning Lancashire. Schlosberg (2009) referred to the idea of an 'unloved place' as recognition-related environmental justice; fracking is appropriate for the aforementioned industrial/ northern/ Scottish/ Welsh regions compared to more affluent Southern areas constituencies such as Balcombe in Sussex[26] . This discourse-level prioritises the needs and concerns of affluent South-Eastern or urban citizens over economically marginalised northern or rural citizens. This is an environmental justice issue, and I will discuss environmental justice-related matters below.

Environmental justice issues are categorised into 'distributional fairness' and 'procedural fairness' (Cotton, 2017). Distributional fairness of fracking is the evaluation of the geographical dimensions of the impacts of fracking. This often manifests as the concentration of environmental risk within predominantly rural and post-industrial regions

[25] Conservative peer and former Energy Secretary

[26] There are significant protests at Balcombe against onshore oil and gas exploration from anti-fracking social groups, even when no fracking was proposed) (for more information on the Balcombe site, see: O'Hara et al., 2013)

while energy security, tax revenues and fuel profits are distributed beyond the local communities (Cotton, 2017).

Procedural fairness, on the other hand, is not solely outcome-based, i.e., who is affected and how, but rather examines the process including, how decisions are made in terms of who is involved, what power they wield, what responsibilities they have and what institutional structures affect decision-making process (Cotton, 2017). Achieving fair fracking involves assessing the relationships between distributive and procedural fairness. Procedural fairness and distributive fairness are directly linked because local and central governance institutional apparatuses influence the just allocation of economic benefits and environmental harm in a society (Kaswan, 2003; Schlosberg, 2009). Fair outcomes are dependent on establishing fairness, honesty, transparency and accountability in resolving disputes, in the distribution of environmental risk and the allocation of resources (Lawrence et al., 1997).

Justice as Fairness

The threats to equality and informed consent commonly underlie violations of environmental justice (Shrader-Frechette, 2005). All citizens should be given equal consideration concerning a decision over distributive outcomes. According to Shrader-Frechette's (2005, p. 25) Prima Facie Political Equality (PFPE) principle “equality is defensible and that only different or unequal treatment requires justification” in the sense that the onus for justifying environmental risks rests with those proposing potentially environmentally damaging developments, not those opposing them.

Distributive justice is defined as “morally proper apportionment of benefits and burdens” and should environmental harm occur; equality will be ensured by requiring economic opportunities and benefits to be evenly distributed (Cotton, 2017, p.185). This directly

relates to the need for participatory justice (a form of procedural justice) which involves "institutional and procedural norms that guarantee all people an equal opportunity for consideration in decision-making" (Cotton, 2017, p.188). Procedural justice entails that "stakeholder and expert deliberation be given equal weight'' and that different stakeholder groups including affected local community residents be given "the same rights to consent, due process, and compensation that medical patients have" (Shrader-Frechette, 2005, p. 26).

Distributive and procedural justice are essential because it is unethical to expose a particular group of people to environmental risks without obtaining free, autonomous and informed consent devoid of coercion, with access to relevant information concerning the risks/harms, and the capability to understand the relevant information and use it in individual decision making. (Shrader-Frechette, 2005, p. 24-29).

Justifying Environmental Harm in Lancashire

Shale gas development in the UK is at the exploratory phase rather than the commercial profit-making phase. In 2011, Cuadrilla exploratory drilling triggered seismic activity around the Blackpool area, which caused the government to put a moratorium on drilling. The onus was placed on the industry to prove that fracking can be done without causing harm and having enough safeguards in place. An influential report by the Royal Society and Academy of Engineering (Bickle et al., 2012) followed thereafter by an industry investigation of seismic risk factors (Gree et al., 2012), led the government to recommend that shale gas extraction can be managed in the UK if best practice regulatory safeguards are put in place (Cotton, 2017). Critics have argued that this technical approach to managing risks associated with fracking is favoured by policymakers, but lacks wider stakeholder and public consultation (Williams et al., 2015).

The lack of epidemiological evidence of the long-term public health risks associated with fracking makes fracking policy challenging to craft for governments. The local government took a precautionary approach in response to this lack of evidence, as protecting the public from serious harm from potential environmental risks from fracking takes precedence over enhancing its welfare through economic regeneration (de Melo-Martín et al., 2014). Nevertheless, the government lifted the moratorium on fracking in December 2013. The government mobilised to promote industry expansion through a policy platform described by Prime Minister David Cameron as "going all out for shale" (Watt, 2014). This implied that shale gas was beneficial for job growth and energy security

The 'all out for shale' strategy began under the former Conservative and Liberal Democrat Coalition Government that introduced specific policy mechanisms to stimulate development through initiatives such as tax breaks for industry and local councils, benefits to communities through profit-sharing measures and compensation, and the promise of local employment, to streamline applications for consent by pushing for fracking-related planning reform (Cotton, 2017).

The UK government sought to convince local communities and the general public that environmental harms from fracking will not be the same as in other places such as the US. As David Cameron noted:

> What I would say is recovering unconventional gas will only go ahead with stringent environmental safeguards…I hope that reassures people there is no danger of some dash into technology without the safeguards in place and real payback for local people, in terms of the Community Payback scheme. (Blackpool Gazette, 2015).

Community Payback Scheme

The UK government's quest for shale gas exploration was part of the Spending Round of 2013 (HM Treasury, 2013b). The economic measures included 100% business rate recovery from fracking operations for local authorities (double the existing 50% rate), resulting in an estimated £1.7 million per annum to local authorities for a typical shale gas site (effectively subsidised by the central government) (Prime Minister's Office, 2014a). They also promised to use tax revenues generated from fracking to create a Sovereign Wealth Fund for investment in the North of England (though the exact details on this latter point do not appear in current Government policy documentation). The government simultaneously emphasised the employment benefits, precisely an estimated 16,000–32,000 new full-time equivalent positions (including direct, indirect and induced jobs), creating an increase of up to 7% in the level of employment supported by the UK oil and gas industry sector (Rural Community Policy Unit, 2014).

The Secretary of State for Energy and Climate Change, Amber Rudd, stated that government would sponsor a "National College for Onshore Oil and Gas, headquartered in Blackpool to make sure we get the maximum benefit from the resource and young people have the skills they need to benefit from the new jobs created" (Rudd, 2015, p1). This college aims to improve local skills development in communities where future fracking operations may occur in the UK and potentially alleviate the potential for 'boom town' threats of social decline resulting from rapid external labour migration into an existing economically depressed region (Jacobsen & Parker, 2016), and thus provide a policy mechanism to ensure greater economic equality of opportunity for affected communities.

As the DECC (2014) noted, the benefit provisions to local communities are ensured through the United Kingdom Onshore Oil and Gas's (UKOOG) voluntary charter. The

charter emphasises the redistributive community benefits from the different stages of fracking development. All onshore oil and gas company member organisations of the industry group (including conventional and unconventional onshore oil and gas exploration) must adhere to the charter's guidance. The charter ensures that each well pad should be accompanied by a £100,000 payment to "the local community", plus 1% of future revenues split between the local community and the local authority (DECC 2013a). UKOOG stated in their community engagement charter that this would be split 2/3rd to the local community and 1/3rd at the county level, in total equivalent to payments of between £3 million and £12 million. A further £2.4–£4.8 million per site (or nearly £0.6 billion in total) could be generated in the production phase (thus accounting for the 1% contribution from revenue over the lifetime of each well).

There are several factors to consider in the evaluation of these economic redistribution claims. First, these benefit claims are not universally accepted, and some mining companies such as Ineos have not pledged community compensation in their exploration operations (Gosden, 2015). Although the UK government is seeking to ensure adequate compensation through the Community Pay Back scheme, not all fracking companies are members of UKOOG, because UKOOG is an industrial body, not a regulatory body (Cotton, 2017). Second, the lifetime of a well (quoted figure of about 20 years) is ambiguous, given the geographical differences in production rates and the continuing volatility of gas resource values within international energy markets.

Third, there is no precise mechanism through which payments are made or how they will be ensured over the long term. Fourth, it is unclear whether landowners in the UK would receive payments directly in the manner implemented by federally protected royalty payments in the US or whether these sums will be provided in cash or as other benefits in kind (upgrading or constructing new infrastructure).

The 1% revenue would affect communities differently based upon population density. Individuals within rural communities would likely receive much higher per capita benefits than those in urban/peri-urban communities (if the figures are capped at £100,000 + 1% revenue). It is useful to compare these figures to those found in US fracking communities. For example, Pennsylvania sets a minimum royalty payment at 12.5%, while the US national average is 18.5%, (Schreiber, 2013). This discrepancy in compensation has led to fracking's detractors in the UK questioning the value for money to local communities, given the industry's potential profitability.

The split estate mineral regime[27] associated with fracking is a source of economic injustice. Landowners providing access to fracking activities and those indirectly or directly affected by horizontal drilling disproportionately suffer the burden. This redistribution injustice is addressed by dividing the revenues as a community rather than private individual benefit. According to Cotton (2017), distributional injustice will occur without a precise mechanism for fair distribution of revenues amongst affected communities. This injustice is, in part, caused by an inability to define what a community is. According to Cass et al. (2010), injustices may occur when a community is defined by spatial proximity (homeowners situated closest to the well pad, for example) or role involvement (such as payments given to members of social movements of opposition) (see Cass et al., 2010).

Furthermore, clearer guidelines on the format of payments are needed to identify the type of infrastructure from the proceeds. The community payback is potentially divisive where decision making over expenditures are not independently facilitated. Therefore, a much clearer mandate to local council and industry is needed to avoid potential social conflict within fracking communities. However, as with any risk-bearing industry providing

[27] Split estate mineral regime is where the property right to the surface and the underground are split between two parties

benefits-in-kind, the type, scale and timing of payments are of ethical concern (Cass et al., 2010). Cotton (2013) noted that providing upfront incentives for economically marginalised communities raises the possibility of community bribery.

Economic injustices can be further exacerbated by the scale and geographical distributive justice of fracking site selection. By virtue of fracking sites' geographical location in the UK, the following locations will be affected: Lancashire, North and South Yorkshire, Cheshire, Midlands, South Wales, South and Central Scotland. Coal bed methane and shale are primarily situated in regions where conventional fossil fuels such as coal (mined during the industrial revolution) were drilled, with the primary area under consideration being the Bowland-Hadder gas play that runs across central England to Cheshire, Yorkshire and the Jurassic shale's in the Weald basin in Southeast England (Schulz et al., 2010; Smith et al.,2010).

Environmental Justice and Sustainability.

Environmental justice studies describe strong relationships between environmental quality and human equality (Agyemang, 1989). Wherever environmental exploitation and degradation are happening, they are most likely linked to the question of equity, rights, social justice and quality of life of people (Agyeman & Evans, 2004). Agyeman et al. (2002) suggest three interconnected dimensions of environmental justice (Agyeman et al., 2002).

First, it has been shown by Torras and Boyce (1998) that globally, countries with more equitable income distributions, greater civil and political liberty and higher literacy rates have higher environmental quality (measured in terms of access to clean water and sanitation as well as a lower concentration of water and air pollutants) than those with less equal income distributions, lower levels of literacy and fewer civil rights and political

liberties. Similarly, Boyce et al. (1999) in their survey of the 50 US states found that states with greater inequality in power distribution – measured by tax fairness, voter participation, educational attainment level and Medicaid access – had less rigorous environmental policies, substantial levels of environmental stress and elevated rates of infant mortality and premature death. Morello-Frosch et al. (2001) in a study of California counties found that counties that are highly segregated, with regards to class, race and income, had substantially higher levels of dangerous air pollutants compared to less segregated communities. It appears then that local and global human inequality is bad for environmental quality (Agyeman et al., 2002).

The second dimension of environmental justice is that environmental problems disproportionately affect the poor. While the rich can ensure that their children breathe clean air, that they are warm and well housed, and that they do not suffer from a polluted water supply, those at the bottom of the socioeconomic ladder are unlikely to avoid the repercussions of polluting industries and power generation, motor vehicle exhaust, and the poor distribution of essential services. The unequal distribution of these environmental harms is compounded, in that, nationally and globally, the poor are not the polluters. Environmental pollution and degradation are disproportionately caused by those in the rich high consuming nations, especially the affluent within those societies. The arrival of the US's environmental justice agenda came in response to these environmental and human inequalities (Adeola, 2000; Bullard, 2000).

The third dimension of environmental justice is sustainable development (Agyeman et al., 2002). The policy agenda of 'sustainability' emerged after the publication of the World Commission on Environment and Development's report in 1987. It came into full operation after the 1992 Rio Earth Summit. According to Agyeman et al. (2002), the definition of sustainability places greater emphasis on the need to "ensure a better quality

of life for all, in a just and equitable manner, whilst living within the limits of supporting ecosystems" (Agyeman et al., 2002, p 78). Environmental management is an essential aspect of sustainability. However, a truly sustainable society is one where broader questions of economic opportunity and social needs and welfare are integrally related to ecosystems' environmental limits (Agyeman, 2000; Bullard, 2001; Dobson, 1999).

The emphasis on equity as a just social goal is linked to the recognition that unless society strives for a higher level of economic and social equity (within and between nations), the long-term objectives of a more sustainable world are unlikely to be realized. This view is that sustainability entails the careful utilization of scarce resources and a more considerable extent, a change of the affluent's high-consuming lifestyle. These behaviour changes will be challenging to achieve because these demands discount short-term goals favouring future generations and unseen 'others' who live on the other side of the globe (Agyeman et al., 2002).

Despite controversies over the relationship between environmental sustainability and environmental justice (Dobson, 1999), it has been argued that justice and sustainability are intimately linked (Agyeman et al., 2002). Goldman (1993, p. 27) suggested that "sustainable development may well be seen as the next phase of the environmental justice movement". There is evidence that this linkage of ideas and practical action is already happening at the local level in organizations such as the Center for Neighbourhood Technology (CNT) in Chicago, Alternatives for Community and Environment (ACE) in Boston, and the Urban Habitat Program (UHP) in San Francisco. They operate within the environmental justice paradigm (Bullard, 1999). For example, the mission of UHP is to build multicultural, urban environmental leadership for socially just and sustainable communities in the San Francisco Bay Area (ECO & UHP, 1998). Other organisations

outside the US, such as the South African Exchange Program on Environmental Justice (SAPEJ) and Friends of the Earth Scotland have similar goals (Agyeman et al., 2002).

The successes of sustainability policies and movements for social and environmental justice are being eroded by globalisation. Due to the global economy's competitive nature, multinational corporations (MNCs) make huge profits through unsustainable production. The MNCs make large gains from neo-liberal economic policies. These benefits come with high social and economic costs in higher pollution levels, greater resource exploitation, less protection for workers and massive social and cultural dislocation (Agyeman et al., 2002).

Not all people bear these costs equally. This is because, traditionally MNCs locate the 'dirtiest' part of the company in countries that offer the least political resistance (Agyeman et al., 2002; Stretesky et al., 2013). In the US, Europe, and across the world, part of the least politically powerful, marginalised and vulnerable population often bears the brunt of environmental harms. According to Agyemang et al.:

> The causes and effects of environmental injustice and unsustainable production are becoming increasingly related in places as far apart as the Mississippi Chemical Corridor in Louisiana, Papua New Guinea, Irian Jaya in Indonesia, the Niger delta in Nigeria, the Brazilian Amazon and Durban's South Basin in South Africa, spurring coalitions between advocates of sustainable development on the one hand, and environmental justice and human rights on the other". (Agyeman et al., (2002, p. 79)

The sustainability agenda has been advanced in the more formal policy-making arenas of governments at all scales and levels from the local (e.g. UK local government), through the state (e.g. California) and national government (e.g. Sweden and the Netherlands) to the international arena (e.g. the 1992 Earth Summit), however, the environmental justice agenda has primarily been advanced through grassroots mobilisation, advocacy and action.

Arguably, the environmental justice agendas are mostly local, and thus different from the multi-scalar sustainability agendas.

A second difference between sustainability and environmental justice is that while sustainability advocates are 'future' oriented – on developing new policy and strategic direction – environmental justice advocates have tended to focus on countering the effects of currently inadequate policies and strategies, as well as the power asymmetries that undermine the quality of life of disproportionately burdened groups (Agyeman et al., 2002). However, this is changing, particularly since the United Nations Research Institute for Social Development's (UNRISD) 'Racism and Public Policy Conference' in Durban, which adopted a position paper on international environmental racism (Bullard, 2001).

Origin of the Sustainability and Environmental Justice discourse

A recent surge in the material that deals with the concept of sustainability and its action-oriented variant 'sustainable development' has led to conflicting and competing views of what the term means and what is the most desirable means of achieving the goal. Sustainability as a concept began from the 'limits to growth' debates in the 1970s and also during the United Nations' Stockholm conference in 1972 (Redclift, 1987). The most quoted definition of sustainable development is the definition coined by the World Commission on Environment and Development (WCED) in 1987: "sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987).

This definition by WCED marked a shift from the traditional, conservation-based usage of the concept developed at the 1980 World Conservation Strategy (IUCN, 1980) to a more appropriate framework that emphasized the economic, political and social context of development. By 1991, the International Union for Conservation of Nature (IUCN)

modified its definition of sustainable development to conform to the description of WCED, and to include "to improve the quality of life while living within the carrying capacity of ecosystems" (IUCN, 1991).

Neither of the definitions of WCED or IUCN mentioned justice and equity, which according to Agyeman et al. (2002) is of fundamental importance. McNaghten & Urry (1998, p. 215), argued that "since Rio, working definitions of sustainability have been broadly accepted by governments, NGOs and businesses. These tend to be cast in terms of living within the finite limits of the planet, of meeting needs without compromising the ability of future generations to meet their needs and of integrating environment and development". McNaghten & Urry (1998, p.215) suggest that there is a:

> growing impetus within the policymaking community to move away from questions of principle and definition. Rather they have developed tools and approaches which can translate the goals of sustainability into specific actions, and assess whether real progress is, in fact, being made towards achieving them".

Within the discourse of sustainability, two themes have emerged (1) hard/strong sustainability and (2) soft/weak sustainability (Jacobs, 1992). Strong or hard sustainability advocates for critical utilisation of natural resources and that non-renewable resources should not be exploited beyond the point where they cannot be replaced, i.e., that critical natural capital must not be exhausted. Weak or soft sustainability accepts that certain resources can be depleted as long as others can substitute them over time. Natural capital can be used up as long as it is converted into manufactured capital of equal volume (Agyeman et al., 2002). According to Agyeman et al. (2002), a problem with weak sustainability is that natural resources (natural capital) cannot be quantified in monetary terms. Therefore, it is impossible to attach a value to it. Strong sustainability maintains that certain ecosystem services functions cannot be substituted by techno-fixes (Agyeman et al., 2002).

Environmental justice advocates follow the ‘‘fair share principle’’ which stipulates that every municipality should have an equal share of environmental ‘good’ and ‘bad’ irrespective of class, race and gender distributions of its population (distributional justice). They also argue that environmental bad should be addressed at the production source (process or procedural justice) (Faber, 1998).

The genesis of the environmental justice movement can be traced to citizen revolts against the establishment of hazardous, toxic, and polluting industries in areas predominantly occupied by black and people of colour in the US (Agyeman et al., 2002). A 1983 Government Accounting Report found that African-Americans made up the majority of the population in three of the four South-Eastern US communities where hazardous waste landfills were sited (GAO, 1983) and the report ‘Toxic Wastes and Race in the United States’ by the United Church of Christ Commission for Racial Justice, 1987 also contributed significantly to the development of public awareness of environmental racism (Bullard, 1999, 2001).

From this arose the theme of environmental injustice, that people of colour through their lack of access to policymaking and decision making processes are forced to live with a disproportionate portion of environmental ‘bad’, and consequently suffer the related public health problems and the quality of life burden. According to Portney (1994, p. 844) “Environmental justice activists claim that the ‘path-of-least-resistance’ nature of locational choices within our economy functions to the detriment of people of colour, and this disproportionate burden is an intentional result”.

Further studies, based in the US, suggest that people of colour live in environmentally degraded areas. They are provided less protection by the US Environmental Protection Agency than whites and more wealthy people (e.g. Lavelle & Coyle, 1992). Moreover, environmental racism claims are linked to limited participation of non-whites in

environmental affairs and the lack of public advocates representing minority and low-income communities (Faber, 1998). According to Faber (1998), advocates of environmental justice argue that the victims of environmental inequities will only be afforded the same protection as others when they have access to the decision making and policymaking process that govern the siting of hazardous materials, and polluting industries.

Some successes of the environmental justice movement can be traced to connections between environmental and social concerns. According to Ringquist (1998, p. 67) “as the mainstream conservationist ideologies of wilderness preservationists received criticism for being elitist, the benefits of adopting more of a social justice perspective on environmental issues, and the broadened base of support that this perspective would enable, became recognised”. Similarly, advocates of social justice perspectives on environmental issues realized the increased credibility, resources, and support in coalitions with mainstream organizations would help their cause. One reason behind the environmental justice movement's successes can be traced to its ability to connect to the rhetoric and discourse of the civil rights movement (Camacho, 1998; Sandweiss, 1998; Taylor, 2000).

Sandweiss (1998) showed how the core mandate of the civil rights movement (which emphasised values such as human dignity, equal opportunity, individual rights, social justice and self-determination) provided a master frame by which victims of disproportionate exposure could make their concerns and views heard. The success of the environmental justice movement in linking environmental, labour and social justice into a master frame through which to communicate claims and clarify goals and grievances to others, and to create a powerful ‘environmental justice paradigm’, has been extensively analysed by Taylor (2000, p. 42). She argues that this “is the first paradigm to link environment and race, class, gender, and social justice concerns in an explicit framework”.

Emerging Voices for Justice

The environmental justice movement developed in the US in response to concerns about the uneven distribution of environmental risk among people of colour. Agyeman, (2000, p. 7), discussing environmental justice in the UK, noted that "it was, in its most specific sense, aimed at people of colour (Bullard, 1997a) and is the term used by activists. However, because of its increasingly broad usage, especially outside the US, it will be used … to include poor and disadvantaged groups as well. As Cutter (1995, p. 113) notes "environmental justice … moves beyond racism to include others (regardless of race or ethnicity) who are deprived of their environmental rights, such as women, children and the poor". In many European countries such as Scotland, the core issues at the fore of the environmental justice movement are class and exclusion issues and not race (Scandrett et al., 2000).

The international dominance of the US experience within the environmental justice discourse is unsurprising given the history and experience of its grassroots communities, and its linkage with the civil rights movement. Other countries worldwide have since recognized the relationship between environmental exclusion and social exclusion, and between environmental degradation and economic exploitation.

In the UK, for instance, there have been initiatives that have sought to link race and racism to environmental issues (Agyeman et al., 2002). For example, the Black Environmental Network (BEN), created in the late 1980s was a UK initiative bringing together black and ethnic minority organizations to address an environmental concern. "Its major campaign at the time was about black access to the British countryside, which was, and still is, seen as an exclusive, ecological white space" (Agyeman & Spooner, 1997, p. 67), which restricts black recreational access because of fears of racism. Many would argue that this is an

access issue, not strictly an 'environmental justice issue', but according to one definition of environmental justice, it includes "the equal distribution of environmental benefits" which includes "the provision of access to open space" (Commonwealth of Massachusetts, 2000).

Although there are examples of environmental justice actions in other parts of the world outside the US such as in the UK, Nigeria, Australia, South Africa and India, few (if any) have developed an 'environmental justice paradigm' (Taylor, 2000), including the environmental justice vocabulary which exists in the US. This does not mean there is no experience of US-style environmental justice issues. Rather, those countries face different environmental justice problems, and each has adopted different strategies to address their issues. In this sense, environmental justice discourse is seen as a unifying process, which brings together different situations and sharing understanding and experience.

For instance, in the case of the UK, Agyeman (2000, p. 8) argued that "what is clearly happening under New Labour, as it was in the US when Clinton took office, is that environmental and sustainability policy discourses and claims are beginning to be re-framed and NGO activists and policy entrepreneurs are driving this. Instead of being framed within a 'green', or predominantly 'environmental' agenda, these discourses are being refocused around the quality of life, using the notions of justice, rights and equity" (Agyeman, 2000, p.8).

Linking Sustainability and Environmental Justice

The common grounds between the concepts of sustainability and environmental justice and their practical actions are vital. Haughton (1999, p 64) notes that advocates need to start "acknowledging the interdependence of social justice, economic well-being and environmental stewardship. The social dimension is critical since the unjust society is

unlikely to be sustainable in environmental or economic terms in the long run".

To a large extent, both sustainability and environmental justice cover similar concerns and issues (Taylor, 2000), but their discourses are syntactically and structurally different. This is because the environmental justice movement was built on the model of the civil rights movement. It has been able to reframe its discourse to environmentalism, using what Taylor (2000, p. 515) has characterized as "elaborated master frames … which are … more inclusive: they are more accessible to aggrieved groups that can use them to express their complaints". Therefore, the framing of environmental justice has created an accessible discourse that those in disproportionately affected groups can identify with. The same cannot be said of the sustainability movement where the discourse is 'future-oriented' and is less tangible for many (Agyeman et al., 2002).

When convergence has happened between sustainability and environmental justice, the results have been promising. For instance, Schlosberg (2003, p. 194) argues that there are a growing number of "examples of cooperative endeavours between environmental justice groups and the major organisations". This collaboration on sustainability and environmental justice can be found in, local fights for just transport (Bullard & Johnson, 1997; Heart et al., 1998), community food security (Gottlieb & Fisher, 1996; Perfecto, 1995), sustainable communities and cities (Haughton, 1999; Rees, 1995; Roseland, 2005), and Scotland's environmental justice campaign by Friends of the Earth (Friends of the Earth Scotland, 2000).

8.2.3 Recommendation for Future Management of Fracking Sites

The approval of fracking in the UK has not been without controversies. Lancashire Council rejected fracking application by Cuadrilla to drill at the Preston-New-Road site. Cuadrilla appealed against this decision, and the community's secretary, Sajid Javid in 2016,

overturned Lancashire's council's rejection of the fracking site. This paved the way for the shale company Cuadrilla to drill.

The local community in Preston-New-Road see this as a betrayal by the national government, and disrespect of their opinions. As we advance, to ensure sustainable management of natural resources, I suggest co-management as an essential tool that will enhance community development and avoid conflicts. I, therefore, discuss the notion of co-management in the next section.

Co-Management of Natural Resources

Global destruction of natural resources has continued unabated, and resource managers still struggle to find incentives to ensure natural resource destruction is halted. One cause of this problem is the centralised management of natural resources without other stakeholders' contribution (Baland & Platteau, 2000; Pomeroy, 1994). Local-level natural resource management cannot be useful in the current web of global multi-stakeholder management approaches (Hersoug & Rånes, 1997). However, there is a call to involve various users in managing natural resources. This phenomenon is known as co-management. This multi-stakeholder approach ensures that stakeholders assume the responsibility of sustaining natural resources (i.e. sustainability) (Hersoug & Rånes, 1997).

According to Hersoug & Rånes (1997), co-management aims to attain improved resource management. However, the theoretical approach to co-management sometimes referred to as 'common property resources', is ambiguous.

The definition of 'community property' is controversial. Berkes & Farver (1989) suggest this stems from the philosophical differences between economists and traditionalists[28].

[28] Tradistionalist implies practices that shows or demonstrate historical continuity among groups of people

According to orthodox economists, property either belongs to the state or is privately owned (individual). Therefore, property that cannot be appropriated by the state or by an individual is termed common property. Traditionalists, however, are of the view that property can be owned equally by a defined group of people (Berkes & Farver, 1989).

The distinctions between economists and traditionalists' views are vital to Hardin's (1968) 'Tragedy of the Commons' model. In his model, Hardin postulated that resources should either be privatised or controlled by the state to enhance sustainable development. He made no reference to the possibility of communal management. However, recently, traditionalist views of resource management have become more widely accepted (Hara, 2003).

The early 1950s marked the creation of groundbreaking concepts such as 'Common Property Theory' (Gordon, 1954; Scott, 1955) and the Tragedy of the Commons' (Hardin, 1968). The widely accepted definition of 'common property resource' in the literature is a "class of resources for which exclusion is difficult, and joint use involves subtractability" (Berkes, 1989; Fortmann & Bruce, 1988; Oakerson, 1986; Ostrom, 1986). An exclusion means that control of assessing to users is problematic and subtractability implies using the resource results in the resource becoming less available to other users. According to Feeney (1994), the definition of common property resources suggests two types of management issues. First, the need to regulate access to the resource to avoid the problem of exclusion and secondly, the need to regulate the level of exploitation by authorised users to deal with subtractability. For a management regime to be successful, the need to adequately address these two issues is essential.

Property Rights

Essential components of 'common property resource' are property rights. Property rights assign benefit streams that are derived from resource utilisation (Bromley, 1989), including

transferability, inheritability, alienability, exclusivity and enforcement mechanism (Alchian & Demsetz, 1973; Hallowell, 1943; Schlager & Ostrom, 1992). Property rights grant entitlement concerning resource use and prescribe rules regarding how these entitlements are exercised. According to Bromley (1989, p. 868) "property right entail rights for those holding them and duties for all others to respect the right".

This entitlement's success depends on an organised social structure of institutional arrangements that include defining and enforcing such rights (Hallowell, 1943; Taylor, 1987)**.** Human exploitation of natural resources has endangered the long-term economic and biological viability of natural capital. 'Tragedy of the Commons', 'Prisoner's Dilemma Game', and 'Rational Choice Theory' are three models that explain why this level of exploitation is now common.

Hardin's (1968) Tragedy of the Commons theory postulates that all properties held in the 'common' will be subjected to over-exploitation and degradation. Hardin postulated that; users of a common resource would be 'better off' if they cheat on the collective agreement. The logical conclusion of the tragedy of the commons is that only private owners or the state can effectively manage resources.

However, Wade's (1987) 'Prisoner's Dilemma Game' focused on the 'collective action problem' and is a vital tool used in Game Theory (Runge, 1984). The idea of Game Theory is that, when two or more people share a resource, their behaviour, choices and actions can be modelled into a game. This can be used to predict the outcomes of decision-making dilemmas.

In this game, participants can neither communicate nor have prior knowledge of each other choices. They either cooperate or defect, and the decisions made by one player will affect the others. The lessons learned from Game Theory are that the tendency to defect is always

stronger than the tendency to cooperate. Each player will maximise his/her benefit by transferring the costs to the others (this is termed ‘free-riding in Game Theory) (Runge, 1984). Unfortunately, “individual rational strategies may lead to collectively irrational outcomes” (Hara, 2003, p. 17).

One of the central problems in social theory is the divergence between individual and collective rationality. Olson (1974) argues that unless the number of individuals is small, or unless there is coercion or some other way to make individuals act in their common interest, “rational self-interested individuals will not act to achieve their common or group interest” (Olson, 1974, p. 2). His arguments are based on the premise that, if one cannot be excluded from benefiting from a collective good once the good has been produced, then one has no incentive to contribute voluntarily to the provision of that good. This is the basis for ‘Rational Choice Theory’ (Olson, 1974).

What is evident from the policy analysis arising from the models is the call for an external authority or agent to regulate the resource for its use. Two approaches have been advocated: privatisation or public (central government management) control of common property resources (Bajerna, 1991; Hardin, 1968). According to Baland & Platteau (2000, p. 429), “the success in resource use regulation is not universally associated with any particular type of property rights regime”. Private property, communal property, and government property have all been associated with successes and failures.

These prescriptions tend to overestimate central governments' ability to effectively manage natural resources and fail to consider local government systems' ability to effectively manage their resources (Hviding & Larsen, 1995; Pomeroy, 1995).

The shift in approach to Resource Management

The failure of state-centric resource management models and schemes has spurred an interest in alternative arrangements that would improve management regimes' efficiency. Schemes and models that are based on user involvement are seen as the appropriate alternative (Hara, 2003). Furthermore, the renewed interest in user-involvement communal property arrangement is also related to the resurgence of interest in grassroots democracy, public participation, and local level planning (Feeny et al., 1990).

The complete devolution of state, communal and private resource management approach is not appropriate. Shared governance involving state regulations and user self-management is the most viable option available. This approach would take advantage of local cultural values and the long-term self-interest of local communities to enhance the sustainable utilisation of resources. In terms of rule enforcement, this approach would also allow for coordination with relevant users and stakeholders over a broad geographic scope at a lower cost (Acheson, 1989; McCay, 1980; Pinkerton, 1989).

Co-Management

These developments discussed in the previous paragraph have made it tempting to look to cooperative regimes whereby authorities consult, cooperate or even delegate important management decision-making policies and responsibilities to user groups. In this view, co-management has been advanced as an exciting concept full of possibilities and promises (Hara, 2003). Hara (2003, p. 19) noted that “co-management is a type of collaborative institutional and organizational arrangement between government, user groups, and stakeholders for effective management of a defined resource”.

Co-management as a management technique is widely used but poorly defined. Sagdahl (1992) and Berkes (1997) stated that scholars have been unwilling to limit themselves to a single definition of co-management in general. McCay & Acheson (1987, p. 32) in their work on community-based initiatives have pointed out that "co-management signifies a political claim (by local people) to the right to share management power and responsibility with the state". West & Brechin (1991, p. 25) define co-management as "the substantial sharing of protected areas management responsibility and authority among government officials and the local people".

Berkes et al. (1991, p. 12) define co-management as "sharing of power and responsibility between the government and local resource users". Borrini-Feyerabend (1996, p. 12), describe co-management as "a situation in which some or all the relevant stakeholders in a protected area are involved substantially in management activities". Jentoft (2000, p. 528) defines co-management as " a collaborative and participatory process of regulatory decision making between representatives of user groups, government agencies and research institutions''. According to Hara (2003, p. 20), perhaps the most effective definition of co-management is that of the World Conservation Congress: "a partnership in which government agencies, local communities and resource users, non-governmental organizations and other stakeholders share, as appropriate to each context, the authority and responsibility for the management of a specific territory or a set of resources" (Berkes, 1997).

According to Pomeroy et al. (2001), co-management as a management approach is a compromise between government concerns for efficient resource utilization and protection, on the one hand, and resource users' concerns for self-determination, equal opportunity, and self-control, on the other. The general functions of co-management are the

encouragement of partnership, the provision of local incentives for sustainable use of resources and the sharing of power and responsibility for conservation.

The co-management approach makes two assumptions: first, that people must have a stake in resource conservation and management, and second, the formation of a partnership between resource users and government agencies is a necessity (Hara, 2003). Therefore, co-management theory seeks a shift from autocratic management of resources to a more joint effort of government agencies and resource users. Co-management affords user groups real influence, in the sense that their practical knowledge makes a difference in the decision-making process (Hara, 2003).

According to Jentoft & McCay (1995), co-management is a unique example of the delegation process where 'self-government' within a legal framework established by government is a fundamental principle, and power is shared between user groups and government. Co-management, therefore, goes beyond mere consultation. The delegated institutions, embodying user interest, have direct roles in joint decision-making and have the authority to make and implement regulatory decisions in specific areas of responsibility (Hersoug & Rånes, 1997).

Moreover, Jentoft (2000), emphasised that the critical component of co-management is a mutual agreement regarding power-sharing, and notes that "co-management is formal, has a charter, it specifies mandates, membership and procedures for election, for representation, provision of knowledge, how and when to have meetings. Co-management also means that there exist rules for deliberation, voting, reporting and the like" (Jentoft, 2000, p. 529). Where these features are lacking, co-management is symbolic and not real.

While the above definitions of co-management are in line with the overall co-management trend, Symes (1997) suggests that co-management should be perceived as an equal

partnership. In this regard, both the state and delegated institutions (in their respective areas of responsibility) are fully recognized and respected by both parties. The foundation of co-management should be built on mutual trust and respect.

This section discussed aspects of natural resources management and the difficulty in accepting common resource management methods. This is due to the common property notion of natural resources. Co-management was proposed as an effective approach that will enhance the good management of natural resources. This is because it involves various stakeholders, including community members, government, and non-governmental agencies. The next section discusses the ethical issues related to fracking.

8.2.4 Ethical Perspective of the Decision to Frack in Lancashire, and Fracking Alternatives

The UK government's main reason for allowing hydraulic fracturing is its ability to generate jobs and enable the UK to be energy independent. This decision may be supported; however, it is vital to consider the moral aspect of fracking. The final section of this chapter discusses hydraulic fracturing's ethical perspective and suggests an alternative to fracking.

Ethical Perspective

In the past decade, natural gas extraction has come to the forefront of global energy discussion due to a novel well stimulation technique (de Melo-Martín et al., 2014). This technique has enabled natural gas to be extracted from shale in an economically feasible manner. This notwithstanding, there have been discussions in the media and the scientific community about this innovation's pros and cons. The debate has mostly focused on economic benefit versus public health concerns and the protection of the environment, with opponents and proponents taking a stand either way (de Melo-Martín et al., 2014).

The core of the issue compares potential gains in economics, employment, energy independence, and national security against potential harms to the environment, climate and public health. Scientific information is scarce, especially epidemiologic research is insufficient (Finkel & Law, 2011; Schmidt, 2011; Finkel et al., 2013). The paucity of research quantifying exact risks and benefits of natural gas extraction by fracking, means proponents and opponents are limited in presenting their arguments. However, reviews of the extant literature provide evidence that supports both sides (Eaton, 2013). For instance, studies suggest that shale gas extraction is responsible for increased methane contamination of underground drinking water aquifers (Jackson et al., 2013; Osborn et al., 2011), while studies suggest methane naturally occurs in aquifers (Davies, 2011; Saba & Orzechowski, 2011; Schon, 2011).

Similarly, the scientific evidence on the impacts of shale gas on climate change is contested. Some studies have found that natural gas produced from shale could be worse for climate change than coal (Howarth et al., 2011; Howarth et al., 2012; Wigley, 2011). Others have provided different findings that support the notion that natural gas may indeed be a transition fuel (Cathles, 2012; Hultman et al., 2011; Jiang et al., 2011).

Despite the scientific uncertainties, national and international governments have decisions to make concerning shale gas extraction. In the US, for instance, shale development has been sanctioned by some states such as Colorado, Texas and Pennsylvania. Other states such as New York and Maryland have placed moratoriums on fracking pending further research and investigation. Still, others such as Vermont have banned shale gas extraction even though the state is not yet an active fracking site. Outside the US, countries such as Bulgaria and France have restricted shale gas extraction, while South Africa, the United Kingdom and Poland are currently seeking ways of drilling (de Melo-Martín et al., 2014).

The ethical perspectives on natural resource extraction such as fracking are rooted in two main arguments: protection from harm versus welfare, and respect for people's autonomy.

Protection from Harm Versus Welfare

The justification for protection from harm over welfare, under conditions of uncertainty when both are not possible simultaneously, is that protection from harm and health is a prerequisite to enjoying freedom. It is not clear if shale gas development's economic gains would be significant (Kelsey et al., 2011). For instance, preliminary research based on 65,000 shale wells by Hughes (2013) found that shale development's economic boom may be over-hyped.

The cost of production may also be underestimated because "well, and field productivities exhibit steep declines, production costs in many places exceed current gas prices, and maintaining production requires ever-increasing drilling" (Hughes, 2013, p. 307). Further research also indicates that, though shale gas development creates jobs, these jobs are temporary and mostly taken by outsiders (Dobb, 2013).

Respect of People Autonomy

The scenario whether a particular risk is deliberately chosen, or is involuntarily imposed is ethically significant not just for the assessment of the level of risk of the specific activity, but also about the legitimacy of subjecting the individual to such risk (Kunreuther & Slovic, 1996; Slovic, 2003). Evidence suggests that residents who live near shale gas extraction sites are opposed to the extraction.

For instance, in the US state of New York, most residents who live in Upstate New York (where actual extraction takes place) are opposed to shale gas development (Sinding, 2013). Even in cases where an extraction has already started, landowners and residents

living near the extraction sites have expressed significant concerns regarding the impacts on their health and the environment (Lustgarten, 2009; Urbina, 2011). Further research by the University of Michigan suggests that, even in US states (such as Pennsylvania) where shale gas extraction is active, most residents would support a moratorium on the gas development pending further research on its risks (Brown et al., 2013).

It is ethical for the public to have enough information on distributing fracking benefits and burdens before being exposed to them. Fracking may be problematic because of the paucity of research on the exact negative impacts and the unwillingness of the gas industry to disclose the full content of chemicals used (de Melo-Martín et al., 2014; Tollefson, 2013).

Alternatives to Hydraulic Fracturing?

There may be an alternative to shale gas that can provide the same economic prospects with the benefit of reducing health and environmental harms (de Melo-Martín et al., 2014). Such an alternative would be ethically appropriate in terms of its economic and social benefits as it would be less harmful to health and the environment. The greenhouse gas component of shale gas is debatable; however, shale gas releases less carbon dioxide gas per unit of electric power than coal. Coal releases many harmful chemicals such as heavy metals (e.g. mercury) and sulphur dioxide (Epstein et al., 2011; NAP, 2009), which are health-damaging pollutants. Coal has been in existence longer than shale gas, and numerous studies have confirmed its poor health (Ahern et al., 2011; Zullig & Hendryx, 2011).

The evidence that shale gas is less harmful than other conventional gas such as coal is inconclusive because shale gas development is in its initial stages. More research is needed to confirm its safety. The cost-benefit analysis of two different energy regimes is complex

because environmental and health outcomes are always incommensurable (de Melo-Martín et al., 2014). In this view, a comprehensive investigation that considers the direct cost-benefit analysis of shale gas and coal would be of immense importance to policymakers.

Alternatively, studies have found renewable energy sources to be equally beneficial and produce less harmful pollutants than unconventional gas such as shale. McCubbin & Sovacool (2013), found that wind power avoids anywhere from $560 million and $4.38 billion in human health and climate-related externalities in some locations compared to natural gas. Further economic modelling research by Pollin et al. (2009), has shown that for every million dollars spent on energy production in the United States, solar and wind creates between 9.5 and 9.8 indirect and direct jobs respectively, compared to 3.7 jobs for oil and gas.

Although shale gas development in the UK is rapidly evolving, there is a need for government agencies, the oil and gas industry, various stakeholders, and the general public to consider the ethical dimensions of exploration before full-scale commercial exploration begins. One issue that must be addressed is the impact of this development on UK communities. In particular, the potential distress caused by hydraulic fracturing will need to be considered in any debate about its development. This thesis has contributed to this policy debate, suggesting trust (in the form of perception of recreancy) must be considered.

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APPENDICES

Appendix A: General Survey Questionnaire

FACULTY OF ARTS, DESIGN & SOCIAL SCIENCES
DEPARTMENT OF SOCIAL SCIENCES
LIPMAN BUILDING

Dear Resident,

We are writing to seek your opinions about the social impact of unconventional shale gas extraction which sometimes is described as hydraulic fracturing or 'fracking.' As you probably know, the UK government has recently given permission to proceed with shale gas exploration in Lancashire. The enclosed questionnaire is voluntary and asks about your views and experiences with these initial stages of unconventional shale gas extraction in your community. Your responses to this survey will form the basis of my PhD thesis at the University of Northumbria, Newcastle upon Tyne.

The enclosed survey is designed to be answered in private, and we have provided a self-addressed, stamped envelope for its return. Your participation in the survey is very important because we need to ensure a broad response to draw meaningful conclusions. The survey should take 25-30 minutes to finish and it is anonymous, so please do not write your name anywhere. The information you provide will only be used as part of this project so only my supervisor and myself will have access to this information. If there are any questions you do not want to answer, please leave them blank.

There are four sections to this survey. Section I ask about the potential impact of shale gas activities in your community. Section II is about community relationships. Section III asks about the potential stress that extraction activities may cause. Finally, Section IV includes general questions about you and your neighbourhood. We ask this last set of questions to see the similarities between people.

Before you begin taking the survey, we want to remind you that your participation is voluntary and there are no known risks of participating. However, if you feel any discomfort associated with the questions on the survey please contact my advisor, Professor Paul Stretesky on phone 07596827481 or email: paul.stretesky@northumbria.ac.uk. You can also contact the Chairperson of Northumbria Research Ethics Committee, email: ethicssupport@northumbria.ac.uk.

Once our study is complete, we will send you a brief one-page summary of the survey results in the post along with information on how you may access the full report.

Thank you once again for taking the time to respond to this survey.

Sincerely,

Feizel Aryee, PhD Student & Paul B. Stretesky (Professor)
Northumbria University
Faculty of Arts, Design, and Social Sciences
Department of Social Sciences
Newcastle Upon Tyne

SECTION I

1.1 Do you believe unconventional shale gas extraction activities have impacted your community in the following ways? Please fill in the appropriate choice for each statement.

	Increased	Stayed the Same	Decreased	Don't Know
Availability of Jobs…….....	❍	❍	❍	❍
Local Business Activity.....	❍	❍	❍	❍
Economic Wealth of Local Residents.....	❍	❍	❍	❍
Property Values.....	❍	❍	❍	❍
Government Services.....	❍	❍	❍	❍
Affordable Housing.....	❍	❍	❍	❍
Road Damage.....	❍	❍	❍	❍
Traffic.....	❍	❍	❍	❍
Noise.....	❍	❍	❍	❍
Industrial Activity.....	❍	❍	❍	❍
Scenic Beauty.....	❍	❍	❍	❍
Quality of Life.....	❍	❍	❍	❍
Community disruption.....	❍	❍	❍	❍
The Natural Environment...	❍	❍	❍	❍
Property Crime.....	❍	❍	❍	❍
Violent Crime.....	❍	❍	❍	❍
Surface water concern.....	❍	❍	❍	❍
Leak of oil, gas or produce water.....	❍	❍	❍	❍
Water quality concern.....	❍	❍	❍	❍
Drug-related Crime.....	❍	❍	❍	❍

SECTION II

This section seeks to find out the relationship between you and your immediate family and friends, your neighbours, the local authority, and the gas company (Cuadrilla Mining).

Your Friends, Family and Neighbours

2.1 Do you live, work, volunteer, have children attending school or run a business in Lancashire?

❍Yes ❍No

2.2 How long have you lived in this community?

Years

2.3 Approximately how many people will you count as close friends, that you (and perhaps your family if appropriate) talk to or associate with frequently in this community?
❍0 – 5people ❍6 – 11people ❍12 – 17people ❍18+people

2.4 How often this week have you had face to face contact with at least one of your relatives or friends in this community, excluding the people you live with?
❍0 – 5times ❍6 – 11times ❍12 – 17times ❍18+ times

2.5 How often did you have face to face contact with at least one of your relatives or friends in this community before exploratory drilling for shale gas started in August 2017?
❍0 – 5times ❍6 – 11times ❍12 – 17times ❍18+ times

2.6 How often did you have face to face contact with at least one of your relatives or friends in this community after exploratory drilling for shale gas started in August 2017?
❍0 – 5times ❍6 – 11times ❍12 – 17times ❍18+ times

2.7 Of your close friends and relatives, how many live in the Westby and Wrea Green area?
❍0 – 5people ❍6 – 11people ❍12 – 17people ❍18+people

2.8 Of your close friends and family, how many live in Lancashire?
❍0 – 5people ❍6 – 11people ❍12 – 17people ❍18+people

2.9 Did you have friends or family in the Westby and Wrea Green area before you moved there?
❍Neither friends nor family ❍Friends ❍Family ❍Friends and family

2.10 Do you get help from your friends or family with children or to help with daily activities?
❍not applicable ❍rarely ❍occasionally ❍Frequently ❍Regularly

2.11 Approximately how many people do you speak with in your community on a regular basis (excluding those you live with)?
❍0 – 5people ❍6 – 11people ❍12 – 17people ❍18+people

2.12 How often did you socialise with your neighbours or people before exploratory drilling started in Westby and Wrea Green area?
❍0 – 5times ❍6 – 11times ❍12 – 17times ❍18+times

2.13 How often did you socialise with your neighbours or people after exploratory drilling started in Preston-New Road?
❍0 – 5times ❍6 – 11times ❍12 – 17times ❍18+times

Relationship with Other People

2.14 Before exploratory drilling for shale gas began, how often did you participate in a local organization or club (i.e. sport, craft, social club)?
❍Never ❍1-5times ❍6 – 11times ❍12 – 17times ❍18+times

2.15 After exploratory drilling for shale gas started, how often do you participate in a local organization or club (i.e. sport, craft, social club)?
❍Never ❍1-5times ❍6 – 11times ❍12 – 17times ❍18+times

2.16 In a one-month period, how often do you help out as a volunteer in the Westby and Wrea Green community before exploratory drilling?

❍Never ❍1 – 5times ❍6 – 11times ❍12 – 17times ❍18+times

2.17 In a one-month period, how often do you help out as a volunteer in other communities after exploratory drilling started?

❍Never ❍1 – 5times ❍6 – 11times ❍12 – 17times ❍18+times

2.18 How often have you taken part in a local community project (i.e. a community/village fair) before exploratory drilling for shale gas?

❍Never ❍1 – 5times ❍6 – 11times ❍12 – 17times ❍18+times

2.19 How often have you taken part in a local community project (i.e. a community/village fair) after exploratory drilling for shale gas?

❍Never ❍1 – 5times ❍6 – 11times ❍12 – 17times ❍18+times

2.20 How often do you participate in activities such as community/village fair that happen in this neighbourhood before exploratory drilling for shale gas?

❍Not at all often ❍Slightly often ❍Moderately often ❍Very often ❍Extremely often

2.21 How often do you participate in activities such as community/village fair that happen in this neighbourhood after exploratory drilling for shale gas started?

❍Not at all often ❍Slightly often ❍Moderately often ❍Very often ❍Extremely often

2.22 If you do not participate in activities in this neighbourhood, why not? Please provide details below

2.23 What types of activities would you participate in if they were available in this community? Please provide details below

Helping Others and Trust in the Community

2.24 Please rate your agreement with the following questions

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Don't Know
By helping others you can help yourself in the long run	❍	❍	❍	❍	❍	❍
When I help others, I expect others to help me in return at another time	❍	❍	❍	❍	❍	❍
I feel safe walking down my street after dark	❍	❍	❍	❍	❍	❍
Knowing people in this community makes it feel like a safer place to be	❍	❍	❍	❍	❍	❍
Most people in this community can be trusted	❍	❍	❍	❍	❍	❍
My community feels like home to me	❍	❍	❍	❍	❍	❍

Connections (trust) with decision makers and gas company (Cuadrilla)

2.25 Please rate your agreement with the following statements:

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Don't Know
I have been asked to express my opinion on what my community's needs are and how to address them	❍	❍	❍	❍	❍	❍
If I had a suggestion or identified a problem in the community, I would contact council or my local councillor to inform them of my views	❍	❍	❍	❍	❍	❍
As a resident, I believe I can influence what happens in my community	❍	❍	❍	❍	❍	❍
Cuadrilla understood my concerns or request.....	❍	❍	❍	❍	❍	❍
Cuadrilla answered questions that I had....	❍	❍	❍	❍	❍	❍
Cuadrilla treated me fairly..... .	❍	❍	❍	❍	❍	❍
Cuadrilla resolved my concern or request.....	❍	❍	❍	❍	❍	❍

2.26 How proud are you to live in this community?

❍Not at all proud ❍Slightly proud ❍Moderately proud ❍Very proud ❍Extremely proud

Sense of Community

2.27 How strong is the sense of community in this/your community?

❍Not at all strong ❍Slightly strong ❍Moderately strong ❍Very strong ❍Extremely strong

2.28 Please rate your agreement with the following statements before exploratory drilling for shale gas started

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Don't Know
This is a close knit community	❍	❍	❍	❍	❍	❍
People in this community are willing to help their neighbours	❍	❍	❍	❍	❍	❍
People in this community generally get along with each other	❍	❍	❍	❍	❍	❍
People in this community seem to share the same values	❍	❍	❍	❍	❍	❍

2.29 Please rate your agreement with the following statements after exploratory drilling for shale gas started

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Don't Know
This is a close knit community	❍	❍	❍	❍	❍	❍
People in this community are willing to help their neighbours	❍	❍	❍	❍	❍	❍
People in this community generally get along with each other	❍	❍	❍	❍	❍	❍
People in this community seem to share the same values	❍	❍	❍	❍	❍	❍

Diversity in the community

2.30 Please rate your agreement with the following statements

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Don't Know
A multicultural community brings positive opportunities to get to know people.	❍	❍	❍	❍	❍	❍
I would enjoy living among people of different lifestyles or cultural background	❍	❍	❍	❍	❍	❍

2.31 What is your overall assessment of unconventional shale gas extraction in Lancashire?

	I Support It	I am Against It	I am Somewhere in Between	I have No Opinion
Shale gas development in Lancashire?	❍	❍	❍	❍
Hydraulic fracturing techniques that allow drilling in Lancashire	❍	❍	❍	❍

Social groups and unconventional shale gas extraction

2.32 Have you ever voluntarily participated in any activities related to an anti-fracking social group?

❍ Yes ❍ No

2.33 How often have you participated in an anti-fracking protest march?

❍Never ❍1 – 5times ❍6 – 11times ❍12 – 17times ❍18+times

2.34 Are you a member of any anti-fracking social group/organisations?

❍ Yes. (Please specify:.....)

❍ No.

2.35 How do you get information about protests and other anti-fracking activities?

❍ Personal conversation
❍ Television
❍ Radio
❍ Mainstream newspaper
❍ Phone calls
❍ Email mailing list
❍ Twitter
❍ Facebook
❍ YouTube
❍ Other (Please specify:.....)

2.36 How often have you participated in, spoke or expressed opinions in a public hearing

❍Never ❍1 – 5times ❍6 – 11times ❍12 – 17times ❍18+times

2.37 How did you get to first learn about fracking?

- ❍ TV
- ❍ Radio
- ❍ Personal conversation
- ❍ Twitter
- ❍ YouTube
- ❍ Facebook
- ❍ Other (Please specify:.....

SECTION III

3.0 Below, is a list of the kind of difficulties people sometimes face after a stressful event. Please read each difficulty and indicate how distressing each of them has been to you during **THE PAST ONE MONTH** with respect to **EXPLORATORY DRILLING FOR SHALE GAS** that started in **AUGUST 2017**. How much have you been distressed by these difficulties?

	Not at all	A little bit	Moderately	Quite a bit	Extremely
Any reminder brought back feelings about it.....	❍	❍	❍	❍	❍
I had trouble staying asleep.....	❍	❍	❍	❍	❍
Other things keep making me think about it.....	❍	❍	❍	❍	❍
I felt irritable and angry	❍	❍	❍	❍	❍
I avoided letting myself get upset when I thought about it or was reminded of it	❍	❍	❍	❍	❍
I thought about it when I didn't mean it	❍	❍	❍	❍	❍
I felt as if it hadn't happened or wasn't real	❍	❍	❍	❍	❍
I stayed away from reminders of it	❍	❍	❍	❍	❍
Pictures about it popped into my mind	❍	❍	❍	❍	❍
I was jumpy and easily startled	❍	❍	❍	❍	❍
I tried not to think about it	❍	❍	❍	❍	❍
I was aware that I still had a lot of feelings about it, but I didn't deal with them	❍	❍	❍	❍	❍
My feelings about it were kind of numb	❍	❍	❍	❍	❍
I found myself acting or feeling like I was back at that time	❍	❍	❍	❍	❍
I had trouble falling asleep	❍	❍	❍	❍	❍
I had waves of strong feelings about it	❍	❍	❍	❍	❍
I tried to remove it from my memory	❍	❍	❍	❍	❍
I had trouble concentrating	❍	❍	❍	❍	❍
Reminders of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or a pounding heart	❍	❍	❍	❍	❍
I had dreams about it	❍	❍	❍	❍	❍

I felt watchful and on-guard	❍	❍	❍	❍	❍
I tried not to talk about it	❍	❍	❍	❍	❍

SECTION IV

In the rest of the questions, we want to find more about you and your background

4.1 What is your postcode? ……

4.2 What's the name of your community? ……..

4.3 How do you identify yourself?

- ❍ Male
- ❍ Female
- ❍ Other (Please specify)……

4.4 Which is your highest level of educational qualification?

- ❍ Did not graduate from secondary school/No qualifications
- ❍ 4 or less GCSE's or equivalent
- ❍ 5 or more GCSE's or equivalent
- ❍ Apprenticeship or Vocational Qualification or equivalent (e.g. NVQ)
- ❍ Post 16 Education, AS Levels, A Levels or equivalent
- ❍ Undergraduate University Degree or
- ❍ Post Graduate Work or Degree

4.5 Which of the following best describes your current work situation?

- ❍ Self-employed
- ❍ Employed full-time
- ❍ Employed part-time
- ❍ Not employed, but looking for work
- ❍ Not employed, not looking for work

4.6 How do you identify yourself? (*please fill in only one*)

- ❍ Native British
- ❍ White/Caucasian
- ❍ Black/ African-American
- ❍ Asian or Pacific Islander
- ❍ Native British
- ❍ Multi-Racial (Please specify:……)

4.7 What is your political orientation?

- ❍ Democratic Unionist
- ❍ Conservative party
- ❍ Liberal democrats
- ❍ Labour party
- ❍ Co-operative party
- ❍ Green party

- ❍ Other (Please specify:.....)

4.8 Please indicate your age bracket

- ❍ Below 18
- ❍ 18 – 24
- ❍ 25 – 34
- ❍ 35 – 44
- ❍ 45 – 54
- ❍ 55 – 64
- ❍ 65 – 74
- ❍ 75 – 84
- ❍ 85+ yearsPlease indicate your approximate weekly house income bracket
- ❍ Up to £599
- ❍ £600 – 1,249
- ❍ £1,250 - £1,999
- ❍ £2,000 - £2,999
- ❍ £3,000 - £3,999
- ❍ £4,000 and above

4.9 Employment status: Are you currently.....?

- ❍ Employed for wages
- ❍ Self employed
- ❍ Out of work and looking for work
- ❍ Out of work but not currently looking for work
- ❍ A Homemaker
- ❍ A student
- ❍ Military
- ❍ Retired
- ❍ Unable to work

Is there anything we did not ask that you would like to tell us?

THE END

Thank you for taking the time to complete this survey. Please return this survey to us using the enclosed postage stamped envelope.